Developing and Evaluating Peer Tutoring Programme (Maths PALS) for Trainee Teachers of SEN Pupils in Saudi Arabia

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Signature: ……

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ABSTRACT

Peer tutoring has become well-established in higher education and, with growing interest in peer learning, has started to gain popularity at school level with evident success in a range of settings and subject areas. Specific implementations such as PALS have become commercial successes based on offering attainment gains and social outcomes while reducing teacher workload. However, the impact on children with special educational needs is variable and there remains a lack of consensus on how PALS can affect performance for such students. Similarly, while there are some studies in the Middle East, the supporting literature for peer-tutoring and PALS is highly Western-centric and relies on adoption of constructivist principles in the wider classroom. Such values are uncommon in the Middle East, with the dominance of traditional values presenting a significant barrier to pedagogical innovation in Saudi Arabia. This study is therefore a timely exploration of how peer-tutoring can integrate with a group's existing traditional pedagogical beliefs, engaging them in more active learning.

The study used a mixed methods design to look at three main aspects of the PALS provision: the effectiveness of teacher training as preparation for leading peer tutoring, how fully was the Maths PALS programme implemented, and the impact on students with special educational needs in terms of a range of mathematics attainment and social outcomes. A 3-month intervention model is used to generate comparisons between an intervention and control pupils, helping to locate this study in the context of other quantitative research from Western countries. This is supported by qualitative data looking at the experiences of staff and students to better understand the specific experience of trying such a novel approach in a Saudi Arabian context. It is argued that attainment progress was satisfactory when considered alongside the substantial social progress, suggesting that peer tutoring has the potential to be a long-term learning strategy and, perhaps more importantly, can open the door to Saudi Arabia developing more purposeful and collaborative learning environments. The age grouping common in Saudi Arabia, spanning a much greater age range than is common in other countries, also offers insight into what makes cross-age peer tutoring effective and suggests that measuring progress in such situations requires more advanced statistical techniques. It is also shown that trainee teachers can be efficiently trained in using PALS and highly rate its impact, indicating that teacher training could be a valuable launchpad for pedagogical innovation in Saudi Arabia.

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1 Chapter One: Introduction

Peer tutoring is most strongly associated with constructivist approaches to learning (Topping et al., 2017), emphasising the value of skills such as reframing, explaining, empathy and critical analysis as part of a student's holistic development. While there are many important variations, discussed fully in chapter 2, some forms of peer tutoring can also be highly empowering for learners as part of a student-centred pedagogy. Developing soft skills and empowering learners are core features of Saudi Arabia's plans for educational reform as part of Vision 2030. This study is therefore a timely exploration of how contemporary Western pedagogy is integrating with an education system currently undergoing one of the most significant policy shifts in the history of Saudi Arabia.

This chapter starts with an outline of the study context. This describes Saudi Arabia's current education system and societal norms before going on to explain how recent policy changes have shown a desire for modernisation in education. More details are then given on how disability and SEN are conceptualised in Saudi Arabia, including some initial discussion of peer interaction in this context. This leads onto the statement of the research problem and how this study seeks to make a contribution, with a brief outline of the proposed methodology ahead of chapter 3.

1.1 Education in Saudi Arabia

Saudi Arabia is the wealthiest country in the Middle East, with the majority of that wealth coming from crude oil (Kingdom of Saudi Arabia Ministry of Finance, 2014). The vast majority of Saudi nationals are employed in the public sector and, while this is less true for recent graduates, jobs are generally secure and well-paid (Looney, 2014). This is reflected in Saudi Arabia's education system, with a strong vocational education provision. The importance of international commerce has also been reflected in the globalisation of Saudi Arabia's higher education, both with respect to Saudi nationals studying abroad and foreign universities establishing in Saudi Arabia (Altbach & Knight, 2007; Wilkins, 2011).

Education in Saudi Arabia is free for all pupils during the first four stages of kindergarten, elementary, intermediate and secondary covering ages 3-19. Students must pass exams at the end of each stage, with one opportunity for make-up exams, otherwise they will be held back for a year (Al-Jadidi, 2012). The final stage of

universal education is a type of further education, offered from ages 15-19, in which the Intermediate School Certificate results will determine whether a student follows an academic or vocational route, either of which can be used to access higher education. Teacher training is provided by the state at two universities, with some foreign-trained teachers also recognised as qualified to teach, particularly in English language (Oyaid, 2009).

Additionally, education is segregated by gender, taught exclusively by teachers of the same gender, the curriculum itself starts to differ by gender from the elementary stage. For example, girls will typically take an hour per week of 'feminine education' while boys take physical education (Al-Sinani, Benn, Al-Ansari, & Gaad, 2013).

1.2 SEN Education in Saudi Arabia

With the founding of the Ministry of Education's Department of Special Learning in 1962, Saudi Arabia was one of the most progressive education systems for SEN in the Middle East (Alquraini, 2010). Provision was originally segregated and reflects what in the UK would be regarded as a medical model of SEN, conceptualised as an outdated model in which disabilities are barriers to learning in contrast with a social model in which the physical and cultural space is the barrier. This can be seen in the categories of hearing impaired, visually impaired, educable mentally retarded, autistic, multi-disabled and physically disabled. Al-mousa (2010) notes these categories seek to avoid ambiguity because many assessors and teachers in Saudi Arabia are reluctant to label children as disabled for social reasons, a clear contrast to a study of SENCOs in England in which lack of funding means that SEN status often has to be fought for (Pearson et al., 2015).

Over several years, legislation was introduced regarding disabled people and their statutory rights with regard to medical care and education (Legislation of Disability, 1987 cited in Alquraini, 2010). This led to specific rights to safeguard equality within educational services for those who have disabilities and learning difficulties and the establishment of Individual Education Programmes (IEPs). A critical area that is also covered is that of assessment procedures and detailed information about how schools should make educational provision for all children within the school community.

One recent change noted by Al-mousa (2010) is away from a deficit model highlighted by the addition of gifted and talented as a category of SEN in Saudi

Arabia. This, Al-mousa argues, indicates that Saudi Arabia is taking a highly pragmatic definition of SEN as any need which is not sufficiently met by standard education provision. The impact of funding also cannot be underestimated. Schools in the UK have an incentive to gain diagnoses of SEN in order to receive more funding. In contrast, since there is no need for extra funding to meet SEN, schools in Saudi Arabia may simply make adaptations without labelling a child (Battal, 2016). Battal makes the point that SEN definition in Saudi Arabia isn't really linked to funding as extra money for schools is not needed in the same way that schools in the UK do. Neither is extra funding procured in the same way as schools in the KSA invariably have enough funds from the state as a matter of course. This means that a UK school has a stronger incentive to get students diagnosed, which might even make them biased. As a result, research into mainstreaming in Saudi Arabia is limited and it is difficult to know the extent to which a wider range of special education needs are met simply as a matter of routine and without classification.

It is pertinent to note that the foundation of the General Secretariat for Special Education has heralded a new phase of development for those who have difficulties or impairments of any kind in that there is an undertaking to work towards providing every child, irrespective of their background, needs or difficulties, with an all-embracing, inclusive education which gives them the opportunity to learn the skills that they will need for their futures. This matches an overall aim of providing a basic education which encourages the development of good foundation skills and knowledge that will enable individuals to enhance their skills as they mature. This in turn will provide them with the best opportunity to provide for themselves after having left school, and make a valuable contribution to the economic structures within Saudi Arabia.

A broader focus on life skills is also reflected in the desire to give more choice to women (Kingdom of Saudi Arabia Ministry of Education, 2017), requiring not just that women gain skills to take advantage of a broader range of study and work options but also meaning that men can no longer assume that domestic needs will be met for them by women. In the same way, physically disabled people should be prepared for more independence while society as a whole should normalise interactions with disabled people. As such, the Saudi context is changing.

These policies have reflected a significant shift in the last decade towards Western models of inclusion as an alternative to separate special school provision, with the

significant funding provided for this resulting in increased inclusion to the extent that more pupils with special educational needs are in mainstream settings than are in special schools (Al-mousa, 2010). However, it should be noted that traditional segregation is difficult to overcome and there is still a way to go before true integration and normalising of difference is achieved. For example, Al-mousa (2010) points out that the government's claim of much greater inclusion is based on fewer students in separate special schools, but many of those pupils are in separate classes within their mainstream school. While students might occupy a closer physical space, actual interaction is therefore very limited and – perhaps most importantly – the belief that students with SEN require a slower pace or special classes remains unchallenged.

More recently, the creation of global standards – embodied in the International Classification of Functioning, Disability and Health (ICF) – by the World Health Organisation have introduced greater consistency in how disability is described and classified (WHO, 2002). This change has effectively broken the false dichotomy between social and medical models of disability, emphasising that needs can relate to context, physical factors, an individual's desired actions, or interactions between these (Norwich, 2013a). While changing to a new system may have been problematic, the single International Classification of Functioning, Disability and Health (ICF) model promises greater understanding, consistency, and a single assessment method (Hollenweger, 2013). Hollenweger (2013) also illustrates how the ICF can accommodate a specific educational context, as shown in the diagrams below.

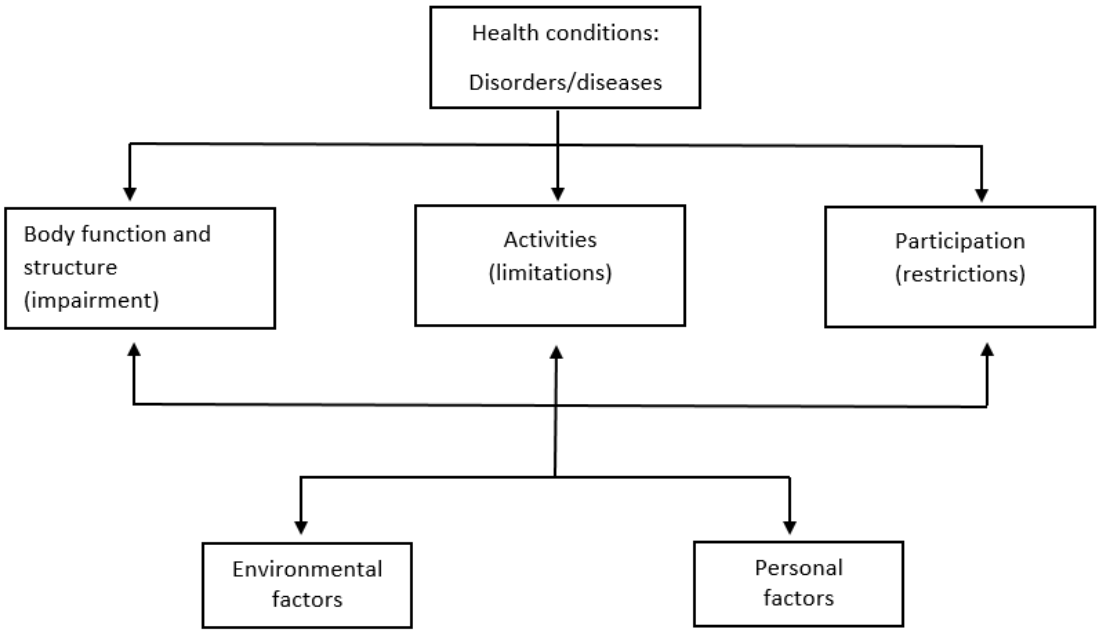

Figure 1.1:ICF Model (WHO, 2002, adapted in Hollenweger, 2013)

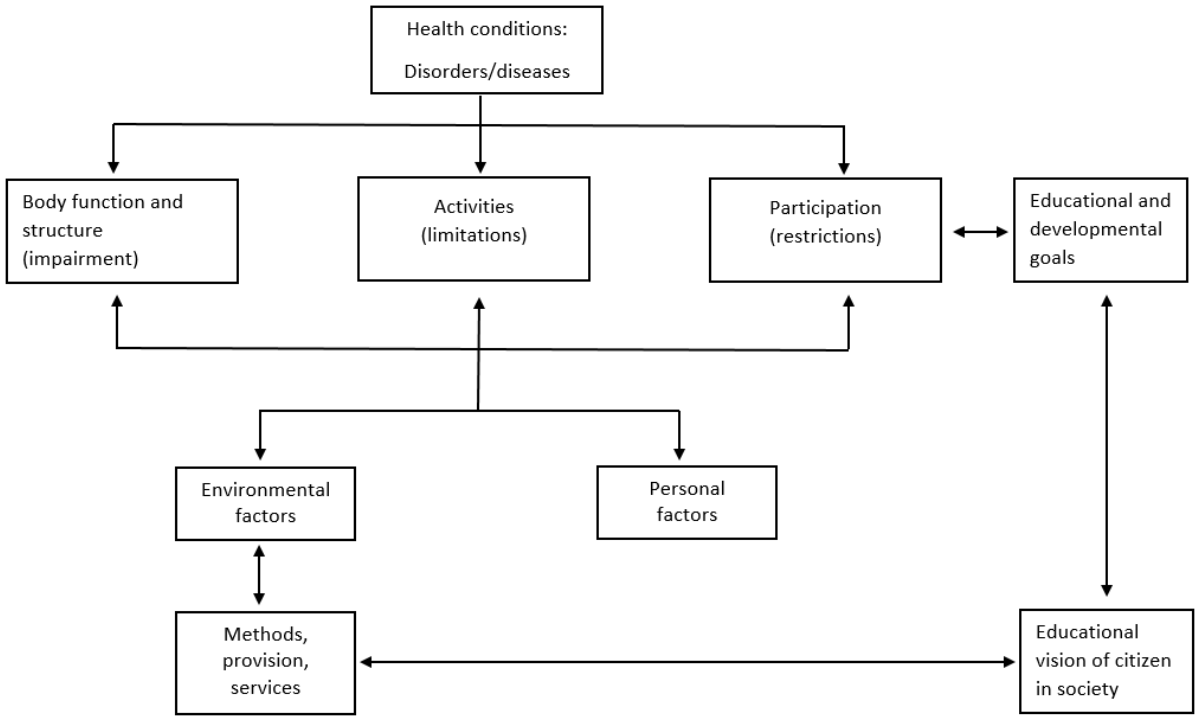

Figure 1.2: ICF expanded for educational use (Hollenweger, 2013)

It can also be seen that the ICF adds fresh emphasis on what an individual might wish to do and their place in wider society. As Saudi Arabia modernises its education

system, these are key discussions with regard to the status of those with SEN. In particular, there will need to be renewed focus on those who may be included in ICF classifications but who do not currently qualify as having SEN under the current system. This is especially relevant, as shown in the next section, for those with moderate learning difficulties or emotional and behavioural difficulties.

1.3 Moderate learning difficulties and Emotional and Behaviour Difficulties

The acronym MLD can refer to either moderate or mild learning difficulties, linking with the less euphemistic description of mild intellectual disability which is characterised by slower rates of learning in social, language and motor contexts which, due to their moderate nature, are only noticed when children begin formal schooling (Westwood, 2009). Terminology in Saudi Arabia tends to be out-dated compared with new terms in the UK, so for example it was common to refer to such difficulties as mild mental retardation until 2007 when phrasing was updated to intellectual disabilities to align with international norms. Both phrases reflect adoption of US definitions. For example, mental retardation was defined in the US as below average intellectual functioning with limitations in two or more areas – "… communication, self-care, home living, social skills, community use, self-direction, health and safety, functional academics, leisure and work" (American Association on Mental Retardation, 1992 cited in Westwood, 2004, p. 134). While the distinction between mild and moderate has been practically lost in common usage, severity was intended to be graded sequentially as mild, moderate, severe or profound, with each category being related to specific IQ scores; mild intellectual disability falls within an IQ range between 70 and 55 (Westwood, 2009).

It is of particular significance to note that the Saudi Arabian interpretation of this definition puts emphasis on the cause of difficulties, in this case low IQ, rather than the consequence. This is significant in classification of Emotional and Behavioural Difficulties since these would not be thought of as learning difficulties or educational needs in the Saudi Arabian system unless they resulted from intellectual disability. In contrast, the UK definition of Emotional and Behaviour Difficulties is less clear-cut, with some pupils thought of having special educational needs if they are unable to control their emotions or reactions to situations, the classification being made under developmental disabilities (Westwood, 2004).

The distinction between daily tasks and school tasks also becomes significant when thinking about mild intellectual disabilities since Westwood (2009) points out that such children may not have experienced any problems in daily tasks until they started school. In the US, this can be categorised quite precisely based on IQ scores (Westwood, 2004), but this measurement is far less common in the UK, so the definition and categories are vaguer. For example, Norwich et al. (2014) demonstrate how applying different quantitative measures could dramatically change the number of pupils classified as having moderate learning difficulties. As well as highlighting the risk of over or under-representing pupils with additional needs, Norwich et al. (2014) make the much more important point that such a flexible definition ensures that best practice recommendations for pupils with MLD will be of little relevance or use to teachers.

One example of this is the definition of mild intellectual disabilities being subsumed by moderate learning difficulties (MLD), which is the largest category of special educational needs in the UK (Norwich et al., 2014). This defines how those designated as MLD "… will have attainments significantly below expected levels in most areas of the curriculum, despite appropriate interventions. Their needs will not be able to be met by normal differentiation and the flexibilities of the National Curriculum" (DfES, 2003, p. 3). The closest similar grouping in the Saudi Arabian system - educable mentally retarded - is similar at around 26% (Al-mousa, 2010, p.37). Semantics aside, these terms amount to much the same description of need but have clearly distinct connotations and were arrived at from very different directions. It can be seen that while the UK definition emphasises difficulties to be overcome in a specific situation, the Saudi definition sees the problem as medically located in the 'retarded' individual whilst at the same time emphasising society's duty to ensure that all those 'educable' can benefit from education.

For the purposes of this inquiry the researcher will consider educable mental retardation, mild intellectual disabilities and moderate learning difficulties together, while acknowledging that there are discrepancies between the categorisations and the inappropriate language in the Saudi terminology. These differences will be highlighted for clarification purposes where appropriate within the body of the inquiry.

1.4 Attitudes towards individuals with SEN/MLD

Despite careful use of language and an emphasis on an individual's right to have a say in their own educational provision, many pupils still feel a stigma attached to any additional support. It has been argued, for example, that the disability or need becomes a dominant label used for a child with special educational needs. Ryan, Reid and Epstein (2004) make an insightful observation that even categories such as gender or ethnicity can be ignored when discussing a child with special educational needs, despite it being far more likely that those children are more likely to think of themselves as a boy or girl before they think of themselves as a disabled boy or a disabled girl. It is therefore important to consider whether the special educational needs label is helpful or if the benefits are outweighed by discrimination or stigma. The Saudi Arabian inclusion of gifted and talented pupils in their definition is perhaps helpful since it emphasises the need for differentiated support rather than inabilities accessing existing support. Some forms of peer tutoring, particularly those which emphasise reciprocity, might also have potential to tackle any stigma.

The classification of those with difficulties has always been problematic, and it is difficult to find universal support for one system in order to provide a common global understanding. The long-held focus in educational circles revolves around classifications involving the abilities of children to function and underlying impairments. This can be demoralising as it emphasises what someone cannot do. The risk here is that overgeneralisation applies the same treatment for students who vary so much within the same classification that they require different approaches. Norwich describes how this type of classification engineers the situation to view all differences as differences of kind (Norwich, 2013b). Classification therefore enables administrators to place learners into 'boxes' for the purposes of the allocation of resources and to make informed decisions about teaching and learning for individual children.

However, there are inherent difficulties with this in that children diagnosed as having a specific condition will not necessarily require or respond to one form of treatment. Norwich (2013b, p. 3) points out those children identified as having mild intellectual disabilities in the USA or moderate learning difficulties in the UK "… might require different teaching approaches" just as those in completely different categories might. An additional issue is that of concentrating on what children are unable to achieve rather than that which they are able to accomplish. Research into the categorisation

of children indicates that the categories may have some educational significance but "… their general nature means that they inform rather than determine specific education planning and provision for individual children" (Norwich, 2013b, p. 112) and risk negative outcomes such as discrimination, exclusion and stigma. It is agreed that a great deal more research and development work needs to be undertaken in order to address these issues and devise a system which is more manageable and comprehensible to all (Norwich, 2013b).

1.5 MLD, EBD, and peer tutoring

While this issue is covered extensively in the literature review, it is worth briefly highlighting the potential of peer tutoring for meeting a diverse range of learner needs and empowering learners as part of a student-centred pedagogy. Given the attitudes discussed above and the popularity of didactic pedagogy in Saudi Arabia, it is important that the potential benefits of peer tutoring are highlighted so that the conceptualisation of the research problem in the following section can be appreciated.

Peer tutoring has been shown to be effective for pupils with EBD, both within mainstream classrooms and in specialist behaviour units (Bowman-Perrott, 2009). This effectiveness has been measured in a range of ways as discussed later, only some of which are compatible with the aims of education in Saudi Arabia. For example, self-esteem might only be considered as a side benefit but there are inspiring examples of this being the main aim of peer tutoring. For example, tutors from secondary schools have helped primary school pupils during school transition, with their emotional response to transition being far more important than any curriculum content they might have learnt (Brady, Dolan, & Canavan, 2014). This was demonstrably the case in a study with severely disabled pupils, including those with Down syndrome, brain injuries and cerebral palsy, where self-esteem and self-concept as part of a more positive learning mindset was the primary aim – and one which was clearly achieved (Kaufman & Burden, 2004). It is therefore crucial that any evaluation of peer tutoring takes full account of the range of possible outcomes and is not simply restricted to evaluations of how well simple factual knowledge is transmitted or retained. As is argued in the next section, this presents a significant challenge in evaluating peer tutoring in a context in which traditional beliefs are strongly held by teachers, parents, and the pupils themselves.

1.6 Statement of the problem and significance of the study

Peer tutoring is a system that has evolved internationally to support the learning of individuals across all age groups and ability levels. It promises development for students not only in academic fields but also with transferable skills and potential for development in personal and social skills. Peer tutoring is an approach that is as yet untried with SEN students in Saudi Arabia, and it remains to be seen whether the technique can be successful in a culture where traditional beliefs about learning are still dominant. In particular, peer tutoring for pupils with SEN, MLD or EBD may prove challenging for an education system in which mainstreaming is still relatively rare and untested.

Some research has been done in the context of Saudi Arabia in the area of implementing peer tutoring for pupils whose primary problem is EBD. For example, the lack of guidance on has been highlighted as a significant barrier to Saudi Arabia's teachers trying the intervention (Abaoud, 2016). It has been shown that gender can interact with the effectiveness of peer tutoring in mathematics (Geerlings, Cole, Batt, & Martin-Lynch, 2016), but this does not necessarily transfer to a segregated education system. Similarly, one explanation for the suitability of peer tutoring for pupils with EBD is that they can feel frustrated at their growing loss of control, so peer tutoring helps to restore some autonomy and decentralises teachers' decision-making (Shogren, Bovaird, Palmer, & Wehmeyer, 2010). However, this may not be relevant if a Saudi implementation of peer tutoring does not decentralise the primacy of the teacher. Furthermore, whereas no research has been done on implementing MLD peer tutoring in Saudi Arabia, the above concerns, such as the lack of guidance, can nevertheless still apply.

Likewise, concerns have already been raised in Western countries that pupils with EBD may disrupt learning more when working in peer groups or dyads, and such concerns seem to be valid for verbal disruption and arguments (Desbiens, Levasseur, & Roy, 2016). Pupils with SEN are routinely kept in separate classes in Saudi Arabia, so such concerns have simply not had to be considered until very recently and may challenge the Islamic ideal that all those who can potentially benefit from education should be given that chance – peer tutoring and inclusion may well be the start of dialogue in Saudi Arabia about the rights of each learner in the class.

There remains a lack of research into SEN generally in Saudi Arabia, and MLD in particular. While some interest has developed as a result of postgraduate students returning to Saudi Arabia from the UK and US, very little of this research is ever published in peer-reviewed journals and is restricted to masters and doctoral theses. Indeed, with the notable exception of Al-mousa, very little of the Saudi Arabian Ministry of Education's research is published in English. It is noteworthy, for example, that Al-mousa is one of the few researchers at the Ministry of Education publishing in English. The distinct features of Saudi Arabia's educational system and its wider authoritarian culture therefore represent an interesting example context for peer tutoring, and one which might have valuable transferability to other Arab nations, especially if any part of this thesis is suitable for publication as a journal article.

1.7 Research aims and objectives

The aims of this research are to develop an effective peer tutoring programme at two levels. First is to offer and evaluate an example of training in peer tutoring by coaching five trainee teachers in the relevant principles, theories and models. The second stage will ask those teachers to introduce peer tutoring in their teaching practice placement with a group of pupils with SEN. Any impact on the pupils' performance in mathematics will be of primary interest, but the study also intended to remain open to evaluating other outcomes such as in motivation, the development of social skills, or building self-esteem. The intervention study comprised 5 classes across 2 state schools in which classes are made up entirely of girls aged 7-15 with a variety of MLDs.

1.8 Personal interest

As someone involved with the education of pupils with SEN, my own professional development involves regularly looking for innovative teaching strategies and programmes to help pupils achieve their best. One programme stood out in mathematics – the Peer Assisted Learning scheme (PALS) – particularly as this was not one of the methods currently shown during teacher training. At the start of the project trainee teachers were due to commence a 4-month teaching practice in a functioning classroom, so the present study therefore seems ideally suited to adding to the repertoire of these trainees at a key point of their career.

1.9 Thesis structure

The overview of Saudi Arabia and introduction to PT given in this chapter is continued in the literature review chapter, where the existing literature on peer tutoring is critiqued to develop a theoretical framework for evaluating PT in a Saudi Arabian context. This leads to a discussion of the approaches to enquiry in chapter 3. Data are analysed and discussed in chapter 4, before chapter 5 summarises the discussion according to each research question in order to relate findings to the current literature, outline the study's contribution to knowledge and limitations, and to highlight implications and recommendations for the practice and policy of teaching and teacher training.

2 Chapter Two: Literature review

2.1 Introduction

This literature review starts by describing the search strategy and type of literature review completed, showing how it has been designed to draw upon the benefits of a systematic review. Peer tutoring has a long and complex history, and can take on such a wide range of forms, that its very definition is contested. The different subtleties within definitions of tutoring are therefore explored in section 2.5 ahead of a more in-depth discussion of how these definitions have evolved as conceptions of peer tutoring have developed. Peer tutoring also varies significantly based on context, most notably the learning environment but also within a broader social context. The literature review therefore also synthesises some of the research into how peer tutoring has developed in specific implementations and how these differ across different domains and contexts. This background is then explored through looking at the theoretical perspectives which inform the practice and development of peer tutoring, which in turn has a significant impact on its use and how the effectiveness of peer tutoring is evaluated.

A range of studies are then reviewed in terms of their analysis of the impact of peer tutoring according to learning outcomes. It is argued that these have previously relied too heavily on crude quantitative proxies for learning, but that this is gradually changing as mixed-methods and qualitative studies fill this gap. In addition to learning outcomes, a range of social and personal objectives are then discussed in terms of how they might support learning, but also can be worthy outcomes in their own right. This leads on to a discussion of peer tutoring's symbiotic relationship with personal and social development through a developing collaborative learning environment. A similar analysis is made in terms of motivation, showing how peer tutoring both relies on a baseline of motivation but can also significantly enhance motivation to collaborate and learn in a community.

Studies specific to Saudi Arabia and Special Educational Needs are considered where relevant throughout, but section 2.9 draws key studies together in greater detail to show some of the ways in which peer tutoring needs careful consideration in new contexts. This is finally drawn together and related to some of the cultural differences between the US/UK and Saudi Arabia to identify where there are gaps in the literature regarding how peer tutoring and PALS interacts with culture.

2.2 Search strategy

This section describes the type of literature review and how elements of narrative and systematic strategies were combined with the aim of balancing personal selection and judgment against allowing findings to emerge from the search. The search terms are shown and explained, as are the filters, which enabled a comprehensive search to narrow down almost 5000 results to just under 500, which were selected for in-depth review.

Choosing the type of literature review: Literature reviews can be described in two main categories: a narrative review and a systematic review, although in practice this distinction can be confused (Jesson, Matheson, & Lacey, 2011). A narrative review is the most common and traditional approach. It can take a variety of styles and methods but is generally taken to mean a critical approach to telling a consistent and logical story or argument which draws upon the literature the reviewer has personally selected. In contrast, a systematic review aims to add more objectivity and transparency into how material was selected, and fits more with a positivist research position – although its popularity is growing in social sciences, where it is seen as the "current zeitgeist in public policy" (Jesson et al., 2011, p.23). The main criticism of a narrative literature review is that replicability is impossible since the method of literature searching is not transparent (Petticrew & Roberts, 2006), so a systematic review offers an alternative by clearly presenting the search terms and tools so that a reader could repeat the process for themselves.

However, systematic reviews can also be criticised for giving the impression of objectivity when the decisions regarding search terms, inclusion and exclusion criteria, and particularly the emphasis given to each study are still all decisions made by the reviewer. A traditional literature review states its aims from the start, so the reader judges the quality of the argument constructed for them in full knowledge of the inductive approach that has been taken. In contrast, a systematic review is based on a deductive approach and gives the impression that its conclusions have emerged from the data. Similarly, a systematic review would systematically favour articles in higher-impact journals. This principle seems sound in the sciences, but in education there could be good reasons for authors to publish strong and relevant work in lower-impact journals – for example, to publish more quickly (Jesson et al., 2011), reach a specific target audience through trade journals, or to fit within an ongoing discussion

in a particular journal. Judging the quality of key papers is therefore a qualitative decision, and one for which explicit inclusion and exclusion criteria is inappropriate.

In the debate about which type of review is best, literature reviews may have fallen victim to the “paradigm wars” (Alise & Teddlie, 2010), so a narrative reviewer may be reluctant to add explicit details of their search strategy since this could be taken as tacit acceptance of the superiority of a positivist approach. A similar argument is made for avoiding numerical descriptions of qualitative data, since saying that 60% of respondents expressed a particular sentiment could be seen to undermine the point of narrative data showing the richness of sentiment rather than just its quantity (Pyett, 2003). In the same way, a narrative literature search might not be objective in how it selects and emphasises some work over others, but that does not mean such a selection is biased or illegitimate. Instead, the literature review relies on the authority of whoever conducted the review and how clearly decisions are described.

Finally, systematic reviews are typically used for very incisive research questions where the aim is to identify a more manageable number of highly relevant studies. In contrast, a narrative review can be thought of as an expert guide or curator taking their reader through the important works in a complex and well-established field. Peer tutoring could suit either review strategy. It has a long history tracing back to constructivist ideals, making it suitable for a narrative review, but also distinct trends and implementations, particularly related to special educational needs and mathematics, which could better suit a systematic review.

The literature search strategy below therefore seeks to avoid either extreme, and instead focuses on the key aim of demonstrating rigour and trustworthiness. The key search term selection and searching strategy is described to show the base upon which the review was conducted, but there is only a simple exclusion filter applied since judgements on what to prioritise were conducted while reviewing abstracts. This was deemed to be particularly important given the niche interest of this study, making it difficult to decide in advance which literature would be most relevant to PALS with SEN group in Saudi Arabia with trainee teachers, since these precise search terms as a combination yielded no relevant results. Overall, this literature review can therefore be conceptualised as a systematic search underpinning a narrative review.

Databases and terms: The British Education Index and ERIC (Education Resources Information Center) databases were chosen as a compromise between breadth and relevance. The EBSCO E-Journal a 'host' search tool through the Library catalogue also came with subject keywords, which are a powerful tool for quickly finding very relevant work. The search tool can also search both databases simultaneously, therefore limiting duplicate results.

The first search performed used the existing keyword “peer assisted learning (pals)”, which gave 33 results, dating back to 1995 (Fuchs, Fuchs, & Phillips, 1995). However, as this was a review study there was clearly a need for a broader search term, since there was relevant research within their review which needed to be considered. The search also missed key texts such as Topping (2005), further indicating that the search was too narrow using just those keywords. The keywords did, however, prove useful in finding new search terms. After search through all 33 results, a list of nine search terms was compiled. A similar search on the British Library ETHOS tool, which catalogues dissertations and theses, provided a check on relevance. Following this, a tenth search term (peer facilitators) was added based on the indexing of Regan (2013). The full list is shown below, alongside the number of results returned for each search in isolation.

Search term	Results
Cooperative learning	15120
Paired pupils	13
Paired students	508
Peer assessment	1729
Peer assisted learning strategies	33
Peer facilitators	209
Peer learning	3479
Peer mentoring	692
Peer tutoring	1693
Peer-assisted learning	225

Table 2.1:Search terms used to compile the search strategy

At each stage, the first page of results was reviewed for any new keywords or words from the titles which could be useful for expanding the search. Similarly, irrelevant results were noted in case the “NOT” Boolean operator could be helpful in making

the search more specific. One early decision was that cooperative learning was high on sensitivity but low on specificity. Peer learning was similarly finding many irrelevant results. It also appeared that some kind of peer-assisted learning or mentoring was popular in nurse education, so using “NOT nursing” was helpful. Finally, “peer teaching” was added as it appeared in several results – on its own, this phrase returned 5102 results. The most relevant phrases were searched through the whole text, while less relevant ones were restricted to searching abstracts. The final search strategy is shown in the screenshot below.

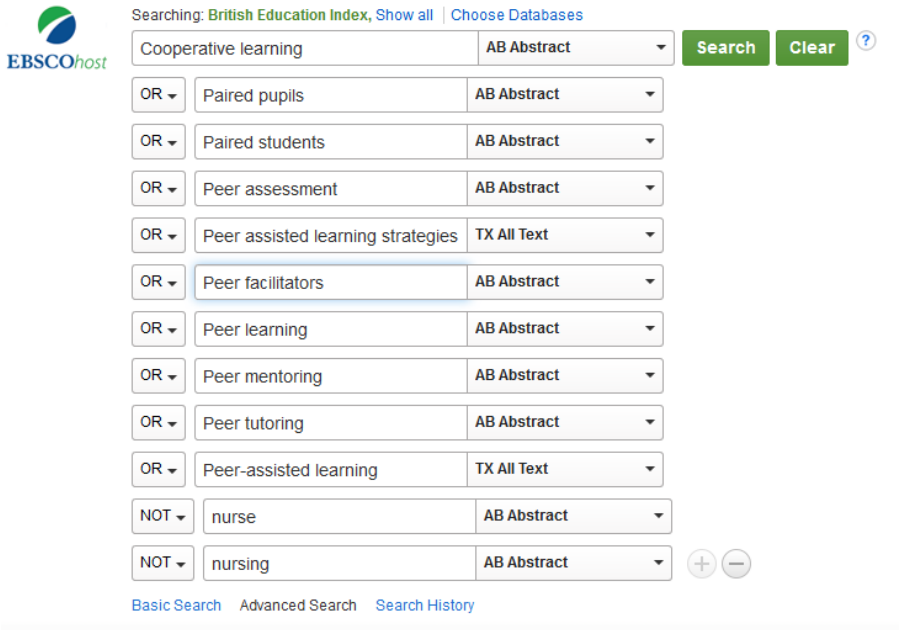

Figure 2.1:Full search strategy screenshot

This initial search gave a total of 11,294 results. Choosing a year to filter is difficult since so much work was conducted on peer-assisted learning in the 1990s, but since there was already a comprehensive review in 2003 (Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller, 2003), this could be taken to synthesise the key points pre-2003. This, plus an English language filter, reduced results to 4,481. These were imported into Mendeley reference management software using the EBSCOHOST export tool. Mendeley includes a range of tools which are more powerful than EBSCOHOST’s web interface. For example, it immediately identified 31 duplicates in the original search. It also allowed searches within the titles and abstracts to filter one criteria at a time. For example, another 13 files had “nurse” or “nursing” in the title and so were not caught by the original abstract filter. In this way, the phrase “higher education” was used to highlight another 1246 results, as shown below.

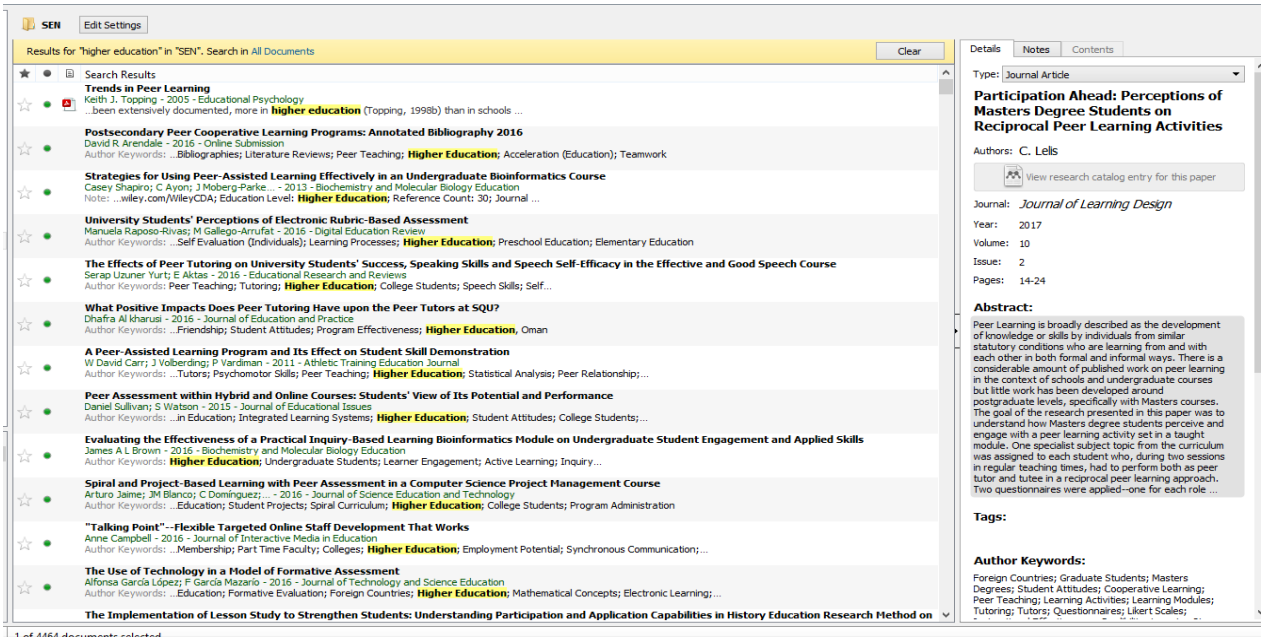

Figure 2.2:Example of filtering search results in Mendeley

This allowed for quicker manual review of relevancy by showing where the search term occurred in each result - so for example, those where it was a key word or in the title could be quickly eliminated since these were not relevant to the age-range of this review. Some higher education studies were still relevant, however, since they tended to theorise more about the effects of peer tutoring and so offered a depth of insight that was largely lacking in the school-based literature. Within just a few hours of the initial search, the scope had been reduced to 3201 documents. These were then reviewed manually by reading titles and abstracts, with irrelevant results deleted and the most relevant texts starred for later. After this final filtering process, 496 results were taken forward into the literature review. An RSS feed was also created to automatically generate new citation alerts.

2.3 Defining key terms

Peer tutoring has a number of different definitions, but is generally understood to refer to a teaching method in which “one child instructs another child”, typically in a context where one is an expert and the other a novice (Topping & Maloney, 2004, 174; Green & Hardman, 2011). Within this definition, the key terms ‘instructs’ and ‘expert’ need to be further unpacked. For example, instruction can range in formality and purpose while expertise can similarly vary from shared and co-created knowledge through to simple error correction.

Expertise is closely related to the purpose of tutoring and task design. In broad terms, peer tutoring is usually concerned with supporting a peer to complete tasks set by the teacher, therefore emphasising both sharing of knowledge and having relatively unambiguously correct answers (Choo, 2008, 11; Duran & Monereo, 2005; Fantuzzo, 2003). In this type of situation, tutors may have already completed a similar task as part of their own learning, or be provided set answers by the class teacher. While there may be some discussion and coaching around technique, this type of tutoring is more associated with simple routine and practice tasks.

One of the most popular formats of peer tutoring, referred to as class-wide peer tutoring, or CWPT, which is characterised as being intra-class, same-age, and reciprocal peer tutoring format (Choo, 2008; Topping, 1996). This format creates some tension between the 'expertise' and 'reciprocal' aspects of tutoring, since peers switch roles, therefore requiring distinct expertise in each interaction. In part, this tension is eased by routine as CWPT systems are designed with this element in mind so that all students work in a tutor-tutee format during each learning session (Biggs & Tang, 2011; Choo, 2008).

In contrast, cross-age peer tutoring refers to a situation in which an older student is chosen to help a younger student (Scott-Little, 2003; Miller & Miller, 1995). There can be a wide variety of different pairings within this context and some of the most common are high school students tutoring elementary school pupils or older students assisting younger students with disabilities (Miller & Barbetta, 1991). This situation makes reciprocity much less likely, since the older student will typically be more expert. Some turn-taking may still be used, but rather than being about returning the favour of reciprocating the gift of tutoring, this is more likely to be a pedagogical tool to help the younger peer consolidate their learning.

2.4 Cross age students and class peer tutoring

It is clear from the above definitions that there is a clear difference between class peer tutoring, which involves intra-class, same age, reciprocal peer tutoring and cross-age peer tutoring, which involves students of different ages in a tutor-tutee relationship. One practical consideration might be the availability of tutors and ease of organising, since tutoring within the same age group and class is simply easier to organise.

Cross-age peer tutoring is therefore more commonly used to achieve specific needs, whereas CWPT may simply be part of the way a class learns. For example, cross-age peer tutoring has been highlighted as a particularly important way for students with disabilities to improve their educational performance and general well-being (Lieberman, 2009). For students with disabilities, particularly younger students and those with more serious disabilities, cross-age peer tutoring has been shown to be far more effective than same-age class peer tutoring (Newcomer, 1997, Lieberman, 2009). This non-reciprocal role requires much more preparation and support, including training and recruiting tutors.

Lieberman (2009) outlines a diverse set of criteria that can be used in order to select an effective cross-age peer tutor, including willingness, physical skills and availability. More important is the expectation that the vast majority of such tutors would have engaged in some sort of training, in contrast to class peer tutoring (Miller & Barbetta, 1991). The training that cross-age tutors engage in can vary from formal training sessions to more informal training, but common to training of both types tends to be an awareness of goals, feedback and problem solving (DeLuca, 2002, 42). In this way, even though knowledge is not shared reciprocally, there is some benefit to the tutor in developing soft skills. Some tutors, for example, might be interested in teaching as a potential career. Tutors might also see tutoring as an extra-curricular enrichment opportunity, gaining volunteer credit or enhancing their subject expertise (Smith, 2007), although this may cause some ethical concerns if some students are offered more support than others. For tutors, this blurs the line between intrinsic and extrinsic rewards and could complicate the tutoring dynamic, potentially even raising ethical concerns if tutors sign up for the wrong reasons.

While there may be more need to select and train cross-age tutors compared with same-age tutors, once tutoring begins the experience can be so positive that the tutoring relationship becomes self-sustaining. For the peer in the pupil role, demonstrable benefits include greater concentration and time on task, improved listening skills, and a range of emotional and cognitive benefits, particularly for learners who need a slower pace of instruction (Gaustad, 1993; Perea, 1995). Equally significantly, positive outcomes are not confined to the tutees, but also includes tutors. Some benefits reported by tutors include higher self-esteem, greater social engagement, and even greater academic engagement in their own studies (DeLuca, 2002; Gaustad, 1993, Schiller, 2000, Anderman & Hattie, 2013). At higher

academic levels, it has even been argued that taking on a tutor role is of more benefit to the tutor than the pupil since it helps to develop a more nuanced and expert understanding of the discipline (Carless et al., 2006). This type of tutoring is therefore much more dialogic than simple error-correction, motivation, or checking correct answers, and so takes much more support to facilitate.

One of the key requirements for facilitating any kind of peer tutoring is establishing trust between tutors and pupils, to which Anderman (2013, 377) further advises the inclusion of practitioner perspectives and the careful determination of tutor/tutee roles and age categorisations. In settings where the timetable is heavily structured, it will often fall to the teacher to organise tutoring spaces and times and determine how this fits with other instruction across the curriculum. Similarly, teachers will often evaluate the success of tutoring, possibly with the support of parents (Woodrow, 2009; Anderman, 2013). These studies highlight how important it is for schools to regularly reinforce the value of tutoring and to update the training of tutors. In contrast, Carless et al (2006) argue that this is not necessary for tutoring in Higher Education.

Despite this extra need for support and supervision, cross-age peer tutoring has been shown to provide a cost-effective mechanism for improving academic performance in relation to mathematics and reading (Gordon, 2005, 69; Gaustad, 1993). For example, Glasgow sampled 22 students with access to cross-age peer tutoring and 23 as control participants with no tutoring and found that literacy development in middle school was significantly improved in the participants with access to cross-age tutoring (Glasgow, 2007, 59). Literacy and mathematics are particularly popular for peer tutoring studies since they offer more easily quantifiable outcomes, such as test scores. The large proportion of teaching time devoted to the subjects also creates space for innovation. For example, a typical primary school in the UK will spend an hour each per day on English and mathematics, so there is plenty of space for tutoring to take up part of each session or be used in a regular weekly slot. In such situations, researchers can evaluate how tutoring interventions compare with the previous (typically teacher-led) approach.

However, these studies might not transfer readily to a Saudi Arabian context, since the majority of teaching time is given to religious education and so teachers may feel under pressure to fit all the teaching content into the available time for English and mathematics.

While studies from Arabic countries are rare, cross-age peer tutoring has been effectively utilised in a wide variety of different contexts, including successfully addressing non-academic outcomes. For example, Goldstein shows how it has been used in order to intervene in cases of school violence and how tutors identified as emotionally disturbed were used in order to teach younger students who had learning disabilities (Goldstein, 2004, 239). In this situation, the skills of being able to relate to the tutee was clearly more important than any particular expertise. This helps to show an example of peer tutoring which is not justified simply in terms of being more cost-effective than teacher-led instruction, but is an intervention that is actually more effective in general regardless of cost. Again, this relates closely to a Saudi Arabian context since schools are under far less economic pressure than their UK counterparts, so any support for peer tutoring innovation would need to be grounded in enhanced learning rather than efficiency or economy.

In Goldstein's (2004) study, these benefits were demonstrated in improved academic and social performance, not just in course grades but also in less frequent disciplinary referrals. This makes a case for some peer tutors being able to work differently to teachers, drawing upon their own experiences and relational skills to build relationships and achieve outcomes that teachers would not be able to address. Perhaps most impressively, these outcomes were achieved with very little intervention from teachers. Tutors were given just a 1-day training workshop, including some subject knowledge enhancement. Tutors then met with tutees twice weekly for 30 minutes, as well as with the tutee's teachers once a week to construct instructional plans (Goldstein, 2004, 239). Outcomes were evaluated after just 10 weeks. This evaluation showed that "tutors demonstrated positive changes in academic and social performance, measured by course grades and disciplinary referrals" (Goldstein, 2004, 241). This shows the dramatic potential for peer tutoring to be highly effective for pupils who teachers traditionally may find hard to reach.

While cross-age peer tutoring is distinct from CWPT, some implementations blend the two approaches. For example, White (2012) found benefits from cross-age tutoring which simply mixed two different-age classes together, thereby partially addressing the limitation that cross-age peer tutoring can be more onerous for teachers to organise (Anderman, 2013). Another example, this time from inner-city Los Angeles, took advantage of cross-age tutoring by involving the tutors in pedagogical decisions and planning, such as preparation of materials (Walraven,

2000). This study showed how cross-age peer tutoring can also support class teachers, for example by providing a different perspective and feedback on what pupils need help with.

In contrast to the diversity in how cross-age peer tutoring can be organised, CWPT tends to follow a simple structure of breaking an entire class into a set of dyads (Dancer, 2007, 36), which may or may not be reciprocal pairs and could also vary in permanence. In general, however, pairs are reciprocal in that the tutor-tutee role alternates within the same dyad. Similarly, while cross-age tutoring can take advantage of a much more expert tutor, CWPT relies on simpler tasks such as providing their partners with prompts, error correction and feedback (Lieberman, 2007, 80), so a tutor's expertise might actually simply be possession of an answer key.

As well as performing a narrower range of tasks than cross-age tutors, CWPT tutors also tend to follow a tighter structure set by the teacher and may even have task cards to keep them focused upon the lesson structure (Lieberman, 2007, 80). This approach has been shown to be especially effective for pupils with mild disabilities since it allows greater inclusion in collective tutoring rather than singling out individuals because of their disability (Johnson & Ward, 2001). Indeed, it may well be that the act of reversing roles within a pair has some intrinsic value - a finding similar to Carless et al.'s (2006) argument that the tutors' own subject knowledge can benefit through the act of forming evaluative judgements and giving feedback to someone else. In particular, role reversal has been shown as highly beneficial for students and that decision-making skills are greatly enhanced by the duality of the tutor-tutee dynamic (Atkinson, 2013; Reynolds, 2007). The role reversal could also help to explain boosts to self-esteem as all pupils get to enjoy the experience of being an expert, but a much wider range of positive impacts on motivation and affect have also been noted (Fantuzzo, 2003).

However, class peer tutoring has often proven to be far more problematic to implement successfully and whereas availability and organisation are often the main obstacles in relation to cross-age peer tutoring, different concerns face class peer tutoring interventions (Guthrie, 2011). Since the whole class is being used rather than a select group of volunteers, training needs can be quite different as pupils vary in their communication skills and aptitude as tutors. Subject knowledge can also be a much more significant barrier than in cross-age tutoring since it is more likely that

CWPT tutors may not even understand the material they are teaching (Gordon, 2005), potentially reinforcing misconceptions. In terms of implementation, much of the same advice is relevant in the case of class peer tutoring as for cross-age tutoring and the role played by practitioner perspectives, trust, determination of roles, inclusion of parents and teachers and careful evaluation also apply (Borman, 1996).

Some students may also resist class peer tutoring on the basis that they are not comfortable with being tutored by classmates (Wellington, 2006), either because they feel peers lack expertise or because they have a more competitive rather than cooperative orientation. This last point may be particularly significant in post-compulsory education. For example, one study concerning the use of class peer tutoring in post-16 psychology set American students a five-page essay. Half of the students completed the essay independently and the other half used a peer tutor. The peer tutor helped students compile research, frame their essay answers and a positive correlation between the presence of a peer tutor and grade was found (Jarvis, 2012, 46). Students might therefore be concerned if they believe that teachers are norm-referencing or marking on a curve, or even that peers could get credit for their ideas.

Nevertheless, while tutoring can be limited by a lack of cooperation, it is also an effective strategy for encouraging cooperation. A good example comes from structures such as “think pair share” and “literature circles” helping to create a more cooperative environment in a class with disabled students (Dieker, 2013, 37-38). In this situation, students with disabilities were given roles (illustrator or connector in literature) that celebrated their gifts and made no mention of their shortcomings or weaknesses. This gave students with disabilities the confidence to participate and fostered a cooperative learning environment for the whole class (Dieker, 2013, 37-38). In other examples, students with disabilities have also been provided with access to technology in a class peer tutoring environment to replace an area of need (Dieker, 2013).

A final consideration is that there is currently no literature showing concurrent uses of peer tutoring. The two approaches are not necessarily mutually exclusive and can address different aims and outcomes. While practitioners might mix tutoring approaches, the research literature overwhelmingly treats cross-age and CWPT as separate entities. This could be used to infer that the situational factors, such as availability and logistics, are dominant in how teachers decide which type of tutoring

to use. For example, there may be a compromise between cross-age tutoring being difficult to organise and CWPT requiring significant tutor training. In addition to these practical concerns, it also seems that practitioners are only using certain types of tutoring in distinct situations. For example, it seems that cross-age tutoring is more common for children with more serious disabilities whereas class peer tutoring is more used in cases where children display mild disabilities. This difference may be explained by the direct reciprocity in the CWPT model (i.e. alternating expert-novice roles), while cross-age tutoring gives different outcomes (e.g. subject knowledge for the novice and teaching experience for the expert). Caution is needed that these assumptions are thoroughly investigated, since students could be missing out on the benefits of different forms of peer tutoring, or even some combined benefits from taking on different tutoring roles for different purposes.

2.5 Peer Tutoring as a developing concept

Peer Tutoring is not a new concept, and Topping (2005a) mentions that it has been established as the longest and most intensively researched form of peer learning. It can be traced as far back in history as the Ancient Greeks (Topping, 1996, p.322). There are also links to Ancient Rome, where the philosopher Quintillian recommended a student tutor as a strong role model for their students while simultaneously providing motivation for them to exceed their achievements, addressing that a child will first strive to “imitate and then to outdo” (Gordon, 2005). Topping (2005b, p.631) argues that it may be “as old as any form of collaborative or community action, and probably has always taken place, sometimes implicitly and vicariously”. Early manifestations of peer tutoring involved children acting as surrogate teachers whose aim was the transmission of knowledge (Falchicov, 2001) and older children helped younger children or those who were less able within their peer group and this practice improved the overall learning within the classroom (Gordon, 2005).

Aleid (2015) highlights how peer tutoring has a long and successful history as a method of effective learning and is a strategy that has been developed in light of Vygotsky’s description of learning as a social process (Vygotsky,1978). This is supported by Haider & Yasmin (2015) who discuss how peer tutoring helps more competent peers to scaffold learners within Vygotsky’s Zone of Proximal Development. Topping (2005b) likewise puts peer tutoring at the heart of constructivist teaching. Within peer tutoring, perhaps the oldest and most widely-

researched peer tutoring model is ClassWide Peer Tutoring (CWPT), which was developed at the Juniper Gardens Children's Project in Kansas City during the early 1980s (Delquadri, Greenwood, Whorton, Carta, & Hall, 1986). This was mainly due to the result of efforts to improve instruction for children with a range of learning disabilities.

The definition of Peer Tutoring by Topping (2005, 631) is perhaps the most popular and one that has been adopted for this study in particular. It can be defined as "the acquisition of knowledge and skill through active learning and supporting among status equals or matched companions. It involves people from similar groupings who are not professional teachers helping each other to learn and learning themselves by so doing." This is a modern conception which contrasts the earlier idea of children acting as surrogate teachers (Falchicov, 2001) and Gordon (2005) who describes peer tutoring as an instructional method in which one child tutors another in material on which the tutor is an "expert" and the tutee is a "novice." A further description which matches Gordon's expert and novice distinction describes peer tutoring as groups of two or three which combine lower achieving students with higher achieving ones for assistance (Mastropieri et al., 2006).

However, Kalkowski (1995) highlights that many definitions such as those mentioned describe the tutoring process involving an expert student assisting a novice, yet this is not always the case. An alternative which reiterates peer tutoring's impact on the whole learning process comes from Slavin (1995), who describes peer tutoring as a component of cooperative learning. In essence, this describes pupils cooperating with and supporting one another to facilitate learning for them both (Colvin, 2007), helping to explain further the benefits of peer tutoring when used in practice. In recent studies, Topping's definition has been implemented - for example, in a programme where peer tutoring was done by university students who themselves had learning disabilities as a support service for others with similar needs (Vogel, Fresko, & Wertheim, 2007), showing the shift from expert-novice pairs to reciprocal peers.

This study focuses on implementing a peer tutoring programme in Saudi Arabia - in particular, PALS - which was first developed over fifteen years in the 1980s and 1990s by researchers working collaboratively with local American school districts (Maheady, 2001). Doctors Fuchs, Fuchs and Simmons wanted to create a peer mediated strategy which combined different peer tutoring methods. PALS was originally designed for use within English and Mathematics for grade one to six

students (Maheady, Mallette, & Harper, 2006) and this was extended downward to kindergarten (K-PALS) (Mathes et al., 2003a) and 1st grade (First Grade PALS) (Mathes et al., 2003c) for beginning reading instruction, and upward for content-area instruction (High School PALS) (Fuchs and Fuchs, 1999). Peer Assisted Learning Strategies (PALS) were developed within the CWPT Juniper Children's Project aforementioned as a form of dyadic instruction (Calhoon & Fuchs, 2003).

Within PALS, learners are paired so that one is slightly more advanced than the other so they can learn from each other as a result of practicing skills in order to reinforce them and that paired learners work together for at least 90 minutes during the course of a week to engage in language and reading practice. During this time, the teacher should supervise the alternation of roles by each learning and, if needed, to provide further instruction to pupils.

PALS is a reciprocal class-wide strategy and the purpose of the original graded 2-6 level programme was to increase strategic reading behaviour, reading fluency and comprehension and three of the main activities were partner reading with retell, paragraph shrinking and prediction relay (Saenz, Fuchs, & Fuchs, 2005). English PALS starts with the higher achiever always reading first to model to the other learner. Work within English involves three tasks: reading aloud, summarising in a few words and predicting, followed by reading the material. Within Maths PALS, student pairs are assigned as the coach and player, where they are assigned a particular mathematics skill and work on a set of problems with the higher performer coaching through using a series of questions and a correction procedure to guide the other student. In this mathematics intervention, both students work on a "game board" with the coach prompts shown on the left and on the right, the players mathematics problems are displayed (Fuchs, Fuchs, Yazdian, & Powell, 2002).

One important aspect of PALS is that it complements and supplements current curricula activity. Maths PALS was developed as a supplement to the existing mathematics curriculum and can be employed two to three times per week to provide extra individualized practice on skills for which expertise has not yet been achieved (Calhoon & Fuchs, 2003). Therefore, the idea is that the PALS treatment enhances teachers' ongoing pedagogy, rather than substituting radically different techniques.

2.6 Typology/Variation and Practice of Peer Tutoring

Peer tutoring has taken different forms depending on curriculum content. Reading and mathematics are the most common, but there are also examples of peer tutoring in physical education (Temple & Lynnes, 2008), music (Jellison, Brown, & Draper, 2015), and careers education (Obiunu, 2008). Peer tutoring in physical education is particularly distinct due to its focus on emotional maturity, requiring different styles of implementation and careful planning from the teacher for each age group (Ayvazo & Aljadeff-Abergel, 2014).

The methods of Peer Tutoring can vary on at least thirteen dimensions and a summary was created in the organisation of these methods (Topping, 2005b). These thirteen dimensions encompass curriculum content, contact constellations, within or between institutions, within or across year groups, same or across ability matching, fixed or reciprocal roles, timing, location, characteristics of helpers, characteristics of helped, objectives, voluntary or compulsory, and reinforcement. Some of these will now be explained and discussed in further detail showing their importance in the overall practice of peer tutoring.

The first organisational issue is curriculum content, which relates to what should be covered in terms of knowledge and skills; this is fundamental and is a key part of the main definition which talks about the acquisition of these areas and is mentioned in the previous section (Topping, 2005). Fulk & King (2001) say that peer tutoring is now an accepted strategy to promote academic achievement and learning across the curriculum. There has been evidence that peer tutoring works in a wide range of subjects including English and Mathematics through PALS (Maheady, Mallette & Harper, 2006) History (Mastropieri et al, 2003), Music (Darrow, Gibbs & Wedel, 2005) and PSHE (Jones, 2007).

As well as the knowledge learnt, skills such as social development are also important in their own right. For example, additional benefits in social skills include improving collaborative and cooperative learning and communication (McGee et al, 1992; Topping, 2005; Kourea et al, 2007) and increased levels of self-esteem for both the tutee and tutor (Miller, Topping & Thurston, 2010). Margolis (2005) highlights that it is through the relation of tutoring to curriculum-related tasks that students can gain motivation from experiencing success and, more generally, develop their levels of self-efficacy. Additionally, Roscoe & Chi (2007) say that peer tutors should focus

more on delivering knowledge rather than developing it, which in turn improves their social skills through teaching.

Another dimension is contact constellation, which refers to how people are organised. Some implementations may operate with one helper working with a group of peers or more intensively in dyads, such as within PALS (Topping & Ehly, 2001). The idea of a group helping peers has also been extended to online, for example, in a study where asynchronous discussion groups were blended with peer tutoring in higher education. However, more peer tutoring seems to involved dyads. For example, through PALS, Calhoon and Fuchs (2003) say that dyadic instruction has demonstrated positive effects for teaching computational and concepts/application skills to elementary students with disabilities.

Two other dimensions mentioned by Topping that are important within the peer tutoring process are related to the age and ability of the students involved. These key organisational issues highlighted create great diversity and scope in the types of peer tutoring that can take place. Falchicov (2001) highlights this, explaining how the term ‘peers’ can have different meanings referring to those of the same age, experience or skill level or to two individuals who are of different ages and levels. The specific types of practice will be further explained in more detail shortly, but for example, Reciprocal Peer Tutoring (RPT) a PALS strategy designed to support same-learner learner dyads of equivalent ability and Cross-Age Tutoring, with older students tutoring younger tutee show the great variation. Additionally, Topping (1996) describes nine different peer tutoring formats suiting different circumstances, which are: “cross-year small-group tutoring, a personalised system of instruction, supplemental instruction, same year dyadic fixed-role tutoring, same year dyadic reciprocal peer tutoring, dyadic cross year fixed-role tutoring, same year group tutoring, peer assisted writing and peer assisted distance learning.”

Consequently, ability and age will affect how the tutoring takes place, particularly in regard to the tutor and tutee. This relates to a further organisational issue described by Topping (2005) as role continuity, which discusses the variance between tutor and tutees staying in fixed roles or pairs taking turns and changing between the two. Duran (2010) highlights how in same-age tutoring the ‘student’ and ‘teachers’ in a pair will exchange roles, so that each play both parts in the exercise. Predominantly, cross-age tutoring doesn’t appear to adopt the same levels of reciprocity within roles,

and older students may be selected as a vehicle to deliver an intervention (Wright & Cleary, 2006).

However, when age, ability and roles are mixed and varied, there have been positive impacts. Topping, Duran & Keer (2016) set up a study that investigated the ongoing interactions in reciprocal same-age and cross-age tutoring pairs and the results indicated more significant differences in cross-age dyads with the general occurrence of interaction. The idea of helper characteristics, another of Topping's dimensions can relate to the idea of this reciprocity being especially important within the peer relationship. Topping highlights within this that there should be challenge for all involved and the overall performance of the 'helper' does also improve. This shows the benefits of exchanging roles within peer tutoring, regardless of the age and ability of the students involved and particularly because a number of studies have indicated that the most important thing is not the age difference, but the skills difference between tutor and tutee (Duran, 2010).

There is also sometimes a misperception around the ages and abilities of students and what constitutes peer tutoring; Gaustad (1993) mentions how peer tutoring generally occurs when tutee and tutor are the same age, but sometimes cross-age tutoring can incorporate the above definition, which can create confusion. Damon & Phelps (1989, p.137) argue that "the phrase "peer tutoring" is something of an oxymoron". Britz, Dixon & McLaughlin (1989, p.17) clarify this by saying "as if the overlap between peer and cross-age tutoring was not confusing enough, peer and cross-age tutoring also go by the names of 'peer teaching,' 'peer education,' 'partner learning,' 'peer learning,' 'child-teach-child,' and 'learning through teaching'". Therefore, peer tutoring could be too broad a definition where age and ability is concerned and something that needs to be considered by researchers before using the terminology. For example, being clearer about whether peer tutoring is reciprocal might help to challenge the idea that only tutees benefit from peer tutoring.

Another important aspect which also relates to ability are the characteristics of those helped, another one of the thirteen organisational issues. These differences can cover a wide spectrum of students, and Topping (2005) said that these include "the very able, those with learning difficulties and those at risk of under achievement included the gifted and talented and other learners with very specific special needs." Coenen (2002) describes how one school that implemented a programme where gifted students were peer tutors, which brought out skills in them such as patience,

wanting to help others and how to deal with difficult situations. As previously mentioned, many peer tutoring programmes focus on those with special needs, for example, students with learning disabilities significantly outperforming others with the similar conditions, when getting peer tutoring in their world history lessons (Mastropieri et al, 2003). Another study by Saenz, Fuchs & Fuchs (2005) focused on using PALS to improve the reading performance of native Spanish primary students with learning disabilities and found this strategy provided strong reading comprehension scores after the peer learning had been conducted.

The final organisational issue is the objective of the peer tutoring. Objectives may relate to curriculum content or have a more social focus in general. It is important to note how programmes have been successful in areas including student interactions and in fostering academic achievement (Utley, Mortweet & Greenwood, 1997). Topping (2005) claims that "projects may target intellectual (cognitive) gains; formal academic achievement, affective and attitudinal gains; social and emotional gains; self-image and self-concept gains or any combination of these." From this, it is important to note that the tutor gains as much out of the experience as the tutee, although this may be for very different reasons as to why the peer tutoring was initially implemented. Clarkson & Luca (2002) claim that the learning is also valuable for the tutor because they are learning through their teaching and the social skills acquired as previously highlighted in Coenen's study (2002).

These thirteen dimensions are important to consider before carrying out any peer tutoring programme and, alongside this, Goodlad (1999) lists seven golden rules as criteria for designing and implementing tutoring schemes which include clearly defining aims and content structure and training and supporting teachers with regular feedback (Clarkson & Luca, 2002). These variations are evident in the different models of peer tutoring which are discussed below. Strain (1996) highlighted how these differ in terms of age (cross age or same age), structure (reciprocal or nonreciprocal), instructional focus (acquisition or practice) and procedural components. Furthermore, Okilwa and Shelby (2010) mention how different configurations of peer tutoring include cross-age matching, reciprocal relationship and classwide pairings (Hughes & Fredrick 2006; Mastropieri et al., 2001) and created a table with these categories alongside others which will now be used to describe all the different peer tutoring models.

The first of these models is Classwide Peer Tutoring (CWPT), which Rathvon (2008) says allows pairs of learners the opportunity to practice skills regularly with increased opportunities for active responding and immediate feedback. This model has already been mentioned previously because it is perhaps the oldest and most widely researched peer tutoring model (Maheady, Mallette & Harper, 2006). Okilwa & Shelby (2010) highlight how with the class, students are paired into tutor and tutee dyads working together on tasks set by their teacher with a standard correction procedure. An important element of CWPT may be competition, with the idea being that encouraging pairs to compete against each other will develop greater cooperation within each pair. For example, Greenwood, Delquardi and Hall (1989) put pairs into teams and awarded points to reward a winning team each day or week Extrinsic motivation helps to make this model successful especially as paired learners are changed when new content is to be learnt which gives all learners the opportunity to be part of a winning team (Dancer, 2007).

The second of the peer tutoring models described in Okilwa & Shelby's table is a recipicrocal relationship which refers to PALS, which has been frequently mentioned because it is implemented within this study. As aforementioned, the specific programmes were designed to help with reading and mathematics and one of the paired learners if slightly in advance of the other which means they can learn from one another by practicing skills and reinforcing them (Institute of Sciences, 2010). Hughes & Frederick (2006) highlight that the unique aspect of PALS is that the tutor-tutee dyads switch roles. From this, a type of PALS was created called Reciprocal Peer Tutoring (RPT) which originally focused on addressing issue for lower achieving children pairs in urban elementary schools and was a success through intervention, with positive behaviour patterns also extending to the general classroom (Fantuzzo, King & Heller, 1992).

RPT works in contrast to mixed-ability peer tutoring because it involves same age student dyads who have comparable ability and has a main aim of keeping both engaged in constructive academic activity (Fantuzzo & Block in Topping & Ehly, 2016). The Access Center (2008) describe this process further mentioning how students can select rewards and goals from a pre-prepared list supplied by their teacher, take turns to devise questions on the topics that they are learning and give each other feedback. Additionally, a successful RPT procedure should also identify concepts which students have not mastered and inform teachers about the quality of

their teaching (Dioso-Henson, 2012). In a study carried out by Fantuzzo, Dimeff & Fox (1989) results of a trial carried out with college students indicated not only improvement in exam scores but also a reduction in student stress levels and an increase in overall student satisfaction.

Another model of peer tutoring is cross-age matching, which also involves tutor and tutee dyads, but these are pupils of varying ages and year groups (Okilwa & Shelby, 2002). Heron, Welch & Goddard (2003) elaborate how younger students in lower grades are matched with older students in higher grades. In a study by Davenport et al. (2004), cross-age tutoring had a positive effect on reading when older students with learning disabilities were paired with kindergarten students. Furthermore, in another cross-age study which involved mathematical games, both eleven-year-old tutors and seven-year-old tutees show significant gains in their overall learning (Topping, Campbell, Douglas & Smith, 2010).

Topping's (2005) final model of peer tutoring is simply defined as other, and includes less-common variants such as reverse-role tutoring. Utley & Mortweet (1997) describe this as a method in which "students with mild disabilities tutor younger students with or without disabilities and group- oriented work to achieve an outcome. The previous study mentioned by Davenport et al (2004) could also fit within a reverse-role model, and Girouard (2013) also shows how a reverse-role peer tutoring improved classroom for children with Emotional and Behavioural Difficulties. Therefore, models such as these which are currently defined under other could have real benefits for people with special needs and deserve to be explored further.

2.7 Theoretical Perspective of Peer Tutoring

As discussed in the literature search strategy, understanding peer tutoring requires understanding the broader learning and teaching context. This will become particularly relevant when applied to Saudi Arabia, since its education system borrows heavily from US and UK policies but is underpinned by quite distinct differences. For example, Saudi Arabia's economy has relied heavily on oil, meaning that a broad curriculum has only recently become an economic priority (Alquraini, 2010). Rights for disabled people are also rooted in Sharia law's enshrining of equality, which emphasises the quality of provision and participation in daily life, in particular physically attending prayers. This has traditionally made parents and local communities responsible for the education of disabled children. This can be seen in

practices such as a student-centred Individual Education Program and education in the Least Restrictive Environment, which are explicitly drawn from US policies, with Saudi Arabia's implementation of these policies focused much more on knowledge and skills than social development.

While much of the phrasing in policies and practices will be familiar to UK and US readers, it is important to remember that Saudi Arabia does not have the same foundation of inclusion, meaning that practices can be quite different. The Saudi Arabian system consequently aims to provide a suitable educational provision for disabled people, whereas UK and US systems aim to facilitate access to the existing provision. These aims are most apparent in further and higher education, with disabled students in Saudi Arabia assumed to be aiming for vocational training rather than higher education, or not requiring any FE or HE if students are both disabled and female (Sim, 2016). This difference can be seen in peer tutoring since mainstreaming and inclusion is far less common in Saudi Arabia, so peers of disabled pupils will often also be disabled. The prevalence of the medical rather than social model in Saudi Arabia also means that peers will have similar physical and mental disabilities, so there is even less diversity within these groups. Peer tutoring in Saudi Arabia will therefore not have the same social goals as elsewhere, with the focus much more on learning than socialisation – although this appears to be changing as educational research develops in Saudi Arabia, particularly as many of its researchers have completed doctoral study in the UK (e.g. Aleid, 2015).

One key difference is in personal and social development aims of peer tutoring implementations (see 1.7.3). Explaining these shared benefits links with the theories of formative assessment and dialogic feedback (Nicol, 2010), with high quality peer feedback helping learners to improve work (Li, Liu, & Steckelberg, 2010), but also the process of giving feedback helping the giver to develop their sense of quality and so improve future self-evaluation (Cho & MacArthur, 2011). This matches with learning as described by Sadler (1989), in which learning is conceptualised in three parts: students knowing the quality of their own work, students knowing the quality required for that work to be good or better, and students knowing strategies to close the gap.

This theorisation of learning has inspired concepts of lifelong learning which see self-evaluation as part of the "sustainable assessment" a learner requires to be able to improve their own work in the future without a teacher (Boud & Soler, 2016). The

literature also differs on the status of tutors depending on theoretical perspectives. Following a Vygotskian approach tends to reinforce the need for emulation of a more competent or older peer (Wallace, Walker, Braseby, & Sweet, 2014), so peer-tutor dyads will typically pair more and less able pupils or make tutoring part of the duties performed by gifted pupils (Yawn, 2012). Purist Vygotskian approaches, such as in Moscow's 'Golden Key' schools, use mixed-age classrooms to facilitate emulation and reflecting learning (Doherty, 2012). Less theory-driven approaches note that peer tutoring and mentoring happens naturally among curious peer groups, so teachers need to facilitate but also stay out of the way (Bowden, 2014), making deliberate construction of dyads less important.

Alternative explanations for the effectiveness of peer tutoring look at the types of learners who are most engaged by it. For example, students who are male or of lower ability are more likely to report enjoying peer tutoring than female or higher ability students (Ghaith & Bouzeineddine, 2003). If certain types of learners are more engaged by peer tutoring than others, then this might suggest a learning preferences explanation rather than a strictly cognitive theorisation of peer tutoring.

Finally, it is worth highlighting that the following analysis include studies from a broad range of countries. This is because studies specific to Saudi Arabia are notably rare, with one researcher referring to this as a "dearth" (Aleid, 2015, p.315). It is therefore difficult to look at cultural adaptations of peer tutoring, and this has been poorly theorised anyway with only a few studies comparing eastern and western approaches to peer tutoring, for example by looking at the need for different reward incentives in Vietnam (Phuong-Mai, Terlouw, Pilot, & Elliott, 2009). If there is little written to contrast eastern and western implementations, there is even less which looks at Arab states. Studies in this review are therefore included from neighbouring countries, such as Kuwait, UAE and Oman.

In Kuwait, for example, teachers are in a heavily centralised system which favours teacher-centred pedagogy and individualism in problem-solving, and this is largely similar to the situation of teachers in Saudi Arabia. Even in this situation, trial studies have shown both learning and social skill gains for peer tutoring conditions compared with teacher-led instruction (Ebrahim, 2012). This is encouraging if Kuwait is taken to be representative of Saudi Arabia, but understanding the increased westernisation of teacher education in Saudi Arabia helps to show how there may be fewer barriers to student-centred approaches in Saudi Arabia.

Such studies give some useful context to Saudi Arabia, but it should also be kept in mind that Saudi Arabia tends to have a stricter interpretation of Islam than its neighbours, and this influence on peer relationships and education more generally cannot be ignored. This study will hopefully help to remedy this dearth of research which is culturally relevant to Saudi Arabia, and joins a small group of masters and doctoral researchers from the UK choosing to study Saudi Arabia.

2.8 The Outcomes of Peer Tutoring on Pupils

This section draws together literature on the outcomes of peer tutoring. For many studies, outcomes are overlapping academic and social goals, as discussed in the theoretical perspectives section (2.7) above. This is still true for the majority of studies in this section, but studies here have been selected where they focused explicitly on particular outcomes. These areas are academic, interpersonal, personal and social, learning environment, and motivation.

2.8.1 Academic learning and attainment

As discussed in section 2.7, the majority of evaluations of peer tutoring evaluate its success on learning outcomes, seeing social outcomes as a bonus rather than the main objective. Other skills, such as leadership and teamwork, are starting to gain interest, but this is with older age groups. For young children, who are the focus of this study, demonstrable academic progress is typically paramount. There is a clear body of research showing this to be sound, to the extent that peer tutoring is now considered evidence-based pedagogy (Stenhoff & Lignugaris-Kraft, 2007). However, the desire to have clearly demonstrable outcomes has meant that research tends towards simple quantitative measures as proxies for learning. This can be a problem when peer tutoring aims to deliver more meaningful longer-term benefits, since readers of such studies might be led to believe that peer tutoring is only for surface learning or drilling of content knowledge.

While they are rare, mixed-methods studies are available to demonstrate progress on both quantifiable measures and more in-depth goals. Results are promising for bilingual pupils, with improvement across a range of qualitative and quantitative measures demonstrated with young learners (Soltero-González, Sparrow, Butvilofsky, Escamilla, & Hopewell, 2016). Other studies have only considered more difficult to measure outcomes such as higher-order reasoning when seeking to solve problems with existing peer tutoring implementations. For example, a study looking

at the need for tutor training was able to demonstrate impact on higher-order reasoning, particularly in summarising and generalising skills in mathematics (Topping, Miller, Murray, & Conlin, 2011). This is supported by research into reading tutoring, in this case PALS, which was found to promote more effective learning strategies in reading tests (Sporer & Brunstein, 2009), but this is not necessarily indicative of higher-order reasoning and could relate more to assessment literacy.

The effectiveness, or otherwise, of peer tutoring has also been explored through comparisons with alternatives. Rather than seeing peer tutoring as extra support, these studies recognise the opportunity cost of what students would have been doing instead if they were not involved in tutoring. Opportunity cost means that everything you do means there is something else you don't do. So if your students are doing peer tutoring, that means they're not doing teacher-led drilling. Peer tutoring therefore not only needs to show that it is helpful, but it needs to be at least as helpful as the alternatives. For example, peer tutoring has been shown to be more effective in terms of test performance than guided notes in history (Mastropieri, Scruggs, Spencer, & Fontana, 2003), reading-writing-presentation methods and computer animations in science (Koç, Yildiz, Çaliklar, & Simsek, 2016), and traditional teacher-led instruction in a range of subjects (Kamps et al., 2008), but no different from other collaborative learning strategies in social studies (Lo & Cartledge, 2004). These studies used simple quantitative measures such as weekly quizzes, and analyses such as t-tests, so while interesting and encouraging, they offer little insight into why peer tutoring was effective – nevertheless, taken together these studies make a strong case for students achieving better results on tests after receiving peer tutoring, with these improvements demonstrated across the curriculum.

In addition to these examples of quantitative measures of the effectiveness of peer tutoring, there is a growing interest in qualitatively understanding why tutoring is effective. Following a synthesis of previous studies, Riese, Samara, and Lillejord (2012) identified three key requirements of peer tutoring: mediational means, trust, and space for disagreement. This alternative perspective shows the importance of the peer/tutor interaction, whereas previous studies mainly focused on the quality of instructional design and the need for structured cooperation to be led by the teacher (Gillies, 2003).

When supporting reading, peer tutoring is often evaluated by measuring comprehension or vocabulary since these are relatively easy proxies to measure and

are both readily improved through the increased practice opportunities offered by peer tutoring (Müller, Richter, Križan, Hecht, & Ennemoser, 2016). This type of measurement has shown peer tutoring to be one of the most cost-effective interventions for reading (Simon, 2011), although others have argued that cost-effectiveness is measured too crudely (Hollands et al., 2016). As an alternative, more detailed studies have looked more broadly at fluency, demonstrating that pupils showed improved fluency on unseen passages as well as those on which they had been tutored (Neddenriep, Skinner, Wallace, & McCallum, 2009). Overall, it therefore seems that rehearsal and repetition is an important part of explaining why tutoring is effective.

The metrics used for evaluation can also affect how peer tutoring is evaluated. A meta-analysis for the US government for PALS in reading found a large effect size for alphabetics (phonics), but no statistically significant gains for comprehension or reading fluency (What Works Clearinghouse, 2007b). A later review by the same organisation found CWPT to be more effective, but the review was only able to find one study which met its quality criteria (What Works Clearinghouse, 2007a). Similar issues exist in peer tutoring in mathematics, with both tutors and evaluators focusing too little on complex problem-solving and instead favouring easier to measure outcomes, particularly those which can be evaluated automatically using computers (Baker, Gersten, Dimino, & Griffiths, 2004). Despite these limitations, one benefit of this narrower focus is that it allows larger scale research, such as a randomised controlled trial which was able to evidence clear statistically significant benefits of cross-age peer tutoring (Topping, Miller, Murray, Henderson, et al., 2011).

For smaller scale studies, however, relying on purely quantitative evaluations can be too limiting, particularly in mathematics peer tutoring involving pupils with emotional or behaviour needs (Hodge, Riccomini, Buford, & Herbst, 2006). Similarly, peer tutoring has shown a lack of collaborative problem-solving opportunities in early years mathematics education (Lopes, Grando, & D'Ambrosio, 2017), which may in part reflect the limited ways in which such programmes are evaluated. Overall, therefore, peer tutoring appears to be beneficial for routine tasks but its effectiveness for more complex learning is difficult to evaluate and demonstrate. In part, this is due to the complexity inherent in assessing complex learning, but it nevertheless encourages caution when adopting peer tutoring strategies for higher-order skills.

One example of evaluating more complex skills comes from PALS used in higher education. The measurement is still a simple quantifiable measure of test performance, but the standard of mathematics being tested is much more sophisticated than at school-level. For example, a simple comparison intervention showed an increase in pass rate from 16% to 42% for undergraduate students who took up the offer of PALS (García, Morales, & Rivera, 2014). Clearly there might be differences in the types of student who engages with any intervention, so this could be explained by motivation or engagement. Nevertheless, a similar study using a more detailed multi-variate analysis found similar results, showing that PALS engagement increased the odds of passing an exam by ten times (Cheng & Walters, 2009). While still using a crude measure of test scores, the assumption that the test is more demanding suggests that PALS may have assisted with more complex learning.

Even with controlling for other variables, the scale of this finding still suggests that there may be some underlying explanation related to students' approaches to learning. This is supported by school-level research in mathematics showing that students' learning preferences could predict their engagement with peer-supported learning (Cheema & Kitsantas, 2016), so being able to confirm understanding by explaining to someone else offers a new learning strategy. Alternatively, the effectiveness of peer tutoring on remedying misconceptions (Sammaraiee et al., 2016) or building assessment literacy (Grünke, Janning, & Sperling, 2016) could help to explain these large improvements in exam performance if the exams were poorly designed. Ideally, studies of non-optional peer tutoring would be needed to help control for this. Similarly, generalising to a school setting is difficult since both these studies compared PALS engagement against not engaging with PALS. This leaves a broad range of unknown activities, whereas school pupils are in a much more controlled environment, and so PALS would need to be compared against the alternative learning and teaching approaches on offer, as in the examples of guided notes and computer animations above.

With so many studies demonstrating the effectiveness of peer tutoring in a range of contexts, more recent studies have looked at reasons for this effectiveness as a means towards finding enhancements. For example, looking at the need for specialist tutor training for peers with hearing impairments helps to show that some pedagogical skill and differentiation is helpful for tutoring to be effective (Herring-

Harrison, Gardner, & Lovelace, 2007). Similarly, technology-assisted peer tutoring has helped to isolate the effect of tutor knowledge, suggesting that subject content expertise is not as important as might be assumed (Mackiewicz, Wood, Cooke, & Mazzotti, 2011). Looking at the effect of pace in tutoring for pupils with special educational or emotional and behavioural needs (Anderson, 2007) has likewise highlighted the value of dialogue and ongoing assessment as part of effective tutoring.

Finally, more in-depth research has started to look at what actually happens during tutor-peer interactions. For example, it has been shown through analysis of video recordings that peer tutoring which involves problem-solving or higher order thinking will naturally prompt pupils to use discipline-specific concepts and vocabulary (Repice et al., 2016). One explanation for this is that peer tutoring gives a clear goal to discussions, so pupils come to see the practical benefits of using discipline-specific vocabulary rather than seeing vocabulary as something to be learnt for its own sake. This type of study helpfully illustrates where academic progress meets interpersonal relationships, suggesting that evaluating these outcomes separately may be a false dichotomy.

2.8.2 Interpersonal relationships

As well as addressing academic progress, some peer tutoring implementations have explicitly aimed to develop interpersonal relationships. This is most evident in the mentoring style of peer tutoring, but also in matching similar peers and tutors so that relationships are formed more easily. Alternatively, pairs might be created which are initially uncomfortable and seek to improve relationships by making pairs work together. For example, in addition to mixing ability or age, social aims of peer tutoring might also require explicitly mixing dyads based on ethnicity (Hossain, Tarmizi, & Ayud, 2012) or disability (Tan, Macey, Thorius, & Simon, 2013).

Nevertheless, peer tutoring has been so successful for integration in broad terms that some implementations see inclusion as its primary function (Jellison et al., 2015). This would fit historically with other peer-learning strategies, such as the jigsaw method of group work which was specifically designed to improve race relations by getting students to value each other's contributions (Williams, 2004), seeing any learning gains as almost a happy accident. However, there is currently no consensus on whether it is better for promoting diversity to match similar or

different pupils and tutors since there is equally no consensus on the aims of this type of peer support.

Studies of language learners have neatly covered the overlap between academic and interpersonal outcomes since so much English as a Foreign Language instruction is based on communicative approaches to learning. Peer tutoring developing language learning is therefore inextricably bound up with developing social functioning and broader peer relationships (Chen & Tse, 2008). Effective group interactions can also be argued to underpin the effectiveness of peer tutoring. Teachers might attempt to stimulate this by assigning group/pair goals but managing individual accountability (Slavin, 2014), while others take a more laissez-faire approach since pupils choosing their own tutors leads to greater collaboration, at least initially (Meisinger, Schwanenflugel, Bradley, & Stahl, 2004). Alternatively, such a relaxed approach might be underpinned by teacher expertise if a learning environment has already been set up according to Piagetian or Vygotskian principles so that pupils really can work well with whoever they choose. Where these principles and meaningful interactions are lacking, peer tutoring and development of interpersonal relationships might be claimed, but the actual implementation is little more than working in groups (Thurston et al., 2007).

Developing interpersonal relationships does not necessarily mean developing respect for equality and diversity. Even in largely homogenous groups, peer tutoring has been used to improve cohesion and relationships as a means to reducing conflict and bullying (Andres & Barrios, 2006). This type of cohesion can also be important for the normal functioning of a learning environment. The importance of interpersonal relationships in effective peer assisted learning is shown by the significant resources required to make PALS work in higher education. For example, a comprehensive study of first-year undergraduates in Ireland found significant demands on faculty co-operation and organisation, but concluded that the effectiveness of PALS in terms of student retention was sufficient to warrant the time and expense (Ginty & Harding, 2014). In contrast with universities, schools benefit from more established peer groups who spend more time together, suggesting that PALS could be both more effective and easier to introduce. Indeed, while PALS in higher education seems to require significant development of interpersonal relationships to enable PALS to function, at school-level the intervention can actually be used to develop interpersonal relationships.

To convincingly include peer relationships in an explanation of why peer tutoring can be effective, it is helpful to know how well peer tutoring functions when relationships are not so good. Unfortunately, few papers are published to explain what does not work; however, one study in the US did show that poor peer relationships limited the effectiveness of peer tutoring (Christianakis, 2010). The importance of peer relationships might also be part of the explanation for peer tutoring either being less successful or requiring more teacher intervention and structure in higher education. For example, peer tutoring often has to overcome overt resistance from adult learners (Allan, 2016) and has low take-up rates even when peer tutoring demonstrably and dramatically improves grades (García et al., 2014).

These findings would suggest that improved peer relationships are part of the explanation for the effectiveness of peer tutoring, which aligns well with social constructivism. It may even be argued that peer tutoring is mainly effective because it helps to restore a more natural learning environment to a school setting. The peer tutoring literature can therefore be helpfully thought of as differing on whether social benefits are a direct aim of peer tutoring, a subsidiary aim in support of learning, or are largely ignored in favour of focusing on academic learning.

2.8.3 Personal and social development

Personal and social development can be linked to academic progress for some learning disabilities, such as in Burks' (2004) case of a pupil whose learning disability meant that he interacted poorly with adults. More generally, however, personal and social development through peer tutoring is often thought of in terms of benefits to the tutor or wider school community rather than just the benefits of the pupil who is being tutored. For example, in the UK, Jones (2007) reports a range of affective benefits for mainstream tutors of peers with autism, including building their confidence, sense of caring, and valuing of diversity. Another study showed that benefits in confidence and social skills persist over time, with benefits still reported ten years later (Gafney & Varma-Nelson, 2007). This type of longitudinal study is rare and so stands in isolation, but it suggests that tutoring helps to develop soft skills which sustain over a student's learning career and bring cumulative benefits.

Not only do tutors and pupils advance in the short-term, but the advantages gained in the short term lead to future learning gains and more self-directed capability. Tutoring very young pupils could also help develop meta-cognitive awareness,

helping tutors to learn about how they learn (Fair, Vandermaas-Peeler, Beaudry, & Dew, 2005). Reciprocal tutoring also appears to have reciprocal social benefits, with young children showing increased positive social interaction following CWPT (Xu, Gelfer, & Perkins, 2005). This has been used to help explain the effectiveness of peer tutoring, as social interactions can grow into learning interactions and shared meaning-making (Flint, 2010).

Taking social benefits as the main aim of peer tutoring can be seen in strategies which have set out to achieve reductions in bullying and improved self-esteem (Bradley, 2016). The importance of such programmes is also suggested by the successful scaling up of anti-bullying peer tutoring (Roach, 2014), an ambition which is difficult to resource and coordinate for learning-oriented peer tutoring programmes (Tymms et al., 2011). However, the effect on self-esteem may be more complex than first thought, with much stronger effects demonstrated for tutors of younger peers than same-age peers (Miller, Topping, & Thurston, 2010). This also demonstrates that different outcomes of peer tutoring can be maximised by different implementations, so it is important for practitioners to reflect upon their aims when designing peer tutoring opportunities.

The high level of personalisation possible in peer tutoring has also seen it applied to multi-faceted problems such as retention of ethnic minority or disabled students in higher education (Rios-Ellis et al., 2015), offering a highly personalised and resilience-focused approach to personal and social development. Such studies emphasise the social bonding value of tutoring aside from just knowledge transfer. This in turn may help to explain the improved performance of stable-membership tutoring relationships compared with shifting-membership groups (Walker, Bush, Sanchagrin, & Holland, 2017) since the improved relationships have longer-term rewards. Such a holistic approach to peer tutoring can also take the form of peer mentoring with more able and socially established peers, helping new pupils to gain skills and social confidence without becoming too reliant on their tutor/mentor (Turney, 2013).

As well as personal and social development providing a foundation for collaborative learning both within tutoring pairs and across the class as a whole (Lynch & Simpson, 2010), developing collaborative skills is also vital for a student-centred learning environment. This may be even more necessary in Saudi Arabia, where a student-centred learning environment is much less common than in the UK. For example, in

a setting culturally closer to Saudi Arabia, Oman, peer tutoring was shown to improve self-concept of English language learners based on three factors which emerged from regression analysis: shared experience, a small age gap, and “encouraging the tutee to try using English even if he/she made mistakes” (Alrajhi & Aldhafri, 2015, p.189). These findings suggest a close relationship between self-concept and a positive learning environment, suggesting that personal and social development may be a necessary first step when introducing such a radically different learning environment.

2.8.4 Positive learning environment

Despite the general enthusiasm for peer tutoring, it is by no means guaranteed to be effective and requires significant preparation from teachers and senior school staff to ensure the learning environment encourages cooperation and collaboration (Buzhardt, Greenwood, Abbott, & Tapia, 2007). There can likewise be differences in the philosophical assumptions of teachers which manifest in peer tutoring implementations, in particular whether constructivist assumptions are seen primarily as an individual endeavour (i.e. subscribing to Piaget) or social endeavour (i.e. subscribing to Vygotsky) (Powell & Kalina, 2009). This could be reflected in the difference between peer tutoring which seeks to develop social relationships for social benefits, such as a sense of belonging or improved self-esteem, and peer tutoring which sees social relationships as a foundation for social constructivism.

Ultimately, these decisions will affect how a learning environment is co-constructed. There are examples of peer tutoring using learning goals to shape a more student-centred learning environment. For example, the “mathematician’s chair” requires students to author problems rather than just helping each other to solve problems set by the teacher (Wu, An, King, Ramirez, & Evans, 2009). Peer tutoring has also provided a different model for parental involvement as part of the broader learning environment, with parents encouraged to act more as peer tutors than teachers at home (Knowles, Harris, & Van Norman, 2017). Peer tutoring has also been found to improve interactions with computer-aided instruction to a greater extent than face-to-face teacher instruction (Tsuei, 2011), thereby challenging assumptions that computer learning is too passive.

As well as supporting Vygotskian aims of modelling a pupil’s learning on the learning of those around them, peer tutoring has been argued to support deeper thinking and

so also supports contemporary practices such as a flipped classroom, in which learners need time to “begin thinking like experts” (Wallace et al., 2014, p.253). This helps to illustrate where pedagogical aims of peer tutoring rooted in constructivism can shape the design of learning environments, with each peer interaction subtly and incrementally shifting emphasis away from teacher-centred pedagogy. Aside from such fundamental changes to the learning environment, peer tutoring also helps economies of scale by offering contact time which would not be possible with paid staff, thereby adding “an additional layer of staffing support” (Rieske & Benjamin, 2015, p.67). This may help to explain the popularity of peer tutoring in higher education since contact time is under so much pressure.

In this respect, Saudi Arabia has an advantage over the UK since its education sector is both smaller and much better funded, keeping pupil to teacher ratios low. For Saudi Arabia, peer tutoring is therefore not as necessary a component of the learning environment in practical terms as it is in the UK. This may mean that implementation of peer tutoring might be lower and more selective. Another benefit of the increased funding is that parents may be less cynical of peer tutoring, meaning that teachers in Saudi Arabia might have less need to convince parents that peer tutoring is pedagogically sound, an issue which has been faced in the US (Kumar, 2009).

As well as staffing pressures driving the growth of peer learning, more prescriptive curricula could pull in the opposite direction (Macnab, 2003). As teachers feel under pressure to deliver more curriculum content, their natural instinct is to take more control of the classroom and teach from the front (Thurston et al., 2007), thereby limiting the risk-taking which is necessary for peer tutoring to be effective (Barney & Maughan, 2015). Moving beyond Vygotskian or Piagetian approaches presents this lack of risk as even greater in terms of learning. For example, heavily controlled peer tutoring or too much emphasis can limit the ability of pupils to think for themselves or challenge authority, a crucial principle for Emerson’s conceptualisation of a liberal education (Williamson & Null, 2008). One of the main challenges of peer tutoring is therefore that it relies on a learning environment which provides a safe place for exploration and risk, which can be demanding and time-consuming to create.

Analysis of video recorded peer tutoring has also suggested that part of its effectiveness is the growing relationship over time, with peers increasingly becoming more integrated and spontaneously alternating roles rather than staying in a fixed power relationship (Chung & Walsh, 2006). Such benefits therefore spread beyond

tutoring pairs and feed into a general classroom climate of cooperation. There are also approaches to peer tutoring which include the aim of reducing power differences over time to even out any novice-expert differences, although this does initially require much more hands-on involvement and expertise from teachers (Pescarmona, 2015).

Crucially, where this type of development does not occur, peer tutoring can be limited to practice and basic recall since untrained tutors tend towards didactic approaches (Berghmans, Neckebroeck, Dochy, & Struyven, 2013). Moreover, peer tutors require ongoing support to maintain the integrity of the programme and avoid reverting back to such approaches (Dufrene et al., 2010), so it is better for teachers if such support comes from the learning environment rather than requiring regular re-training of the tutors.

2.8.5 Motivation

Motivation can link to a positive learning environment since collaboration can be naturally motivating. For example, Falchikov (2001) has argued that reciprocal arrangements help to reduce the sense of obligation felt by a pupil towards a tutor, so there is an intrinsic motivation to reciprocate which in turn stimulates a similar desire in the other partner. A range of explanations have been offered for this, looking at psychological ideas such as reactance and attribution to help explain how pupils respond to being helped by a peer (Yasutake, Bryan, & Dohrn, 1996). This explanation links well with reactance theory, but motivation from the learning environment can also link with attribution theory in which pupils need to learn that helping each other is normal and mutually beneficial so should not be regarded with suspicion. Drawing these points together, Falchikov (2001) concludes that peer tutoring must come with clear justifications for engaging in peer tutoring if pupils are to be effectively motivated.

Peer tutoring has also been related to stimulating intrinsic motivation, so the challenge for a teacher is just in ensuring initial engagement since the positive experience of tutoring will help to sustain it in the longer term. For example, acting as a tutor can help develop a growth mindset and see how knowledge can be created (Olson & Dweck, 2008), while both tutors and pupils can experience greater self-efficacy through mastery of new skills (Van Keer & Verhaeghe, 2005). Encouragement can also come from the peer interactions themselves, with Schunk

(1991) finding that peer tutors can be more influential than adults in motivating pupils. Another benefit of focusing on intrinsic motivation is that extrinsic motivation can sometimes be at odds with the optimal learning environment. For example, a competitive peer tutoring implementation can be highly motivating with young children and is easier for a teacher to implement, but cooperative peer tutoring demonstrates stronger learning gains (Madrid, Canas, & Ortega-Medina, 2007).

Some studies have noted the need to incentivise tutors to behave co-operatively through tangible rewards (Hawkins, Musti-Rao, Hughes, Berry, & McGuire, 2009) or college credit (Marchand-Martella, Martella, Bettis, & Blakely, 2004). However, other implementations have focused on the intrinsic benefits gained from being a tutor, with effectiveness demonstrated across a range of school contexts (Spencer, Simpson, & Oatis, 2009) and in higher education (Lin, Lai, Chiu, Hsieh, & Chen, 2016). A mixed approach is offered by Smith (2007), in which volunteer tutors get access to highly-prized knowledge from a specialist teacher and then get to consolidate this new knowledge through teaching it to peers, although this may be ethically concerning since some students are getting more from the teacher than others.

These studies illustrate how motivation varies significantly based on age range, learning context, discipline, learning environment and the personal and social development of learners. It is broadly agreed that motivation is required for engagement with peer tutoring, but also that peer tutoring does a good job of sustaining motivation once learners are engaged. However, as will be presented in the next section, all of these issues can have different and complex impacts when combined with peer tutoring which seeks to engage learners with special educational needs.

2.9 Peer Tutoring research focusing on pupils with SEN

Studies looking at peer tutoring for pupils with special educational needs were well-indexed and either used the term special educational needs or named a particular condition such as EBD or autism. Others were less precise or, worse, used special educational needs as a blanket term. For example, a meta-analysis by Kroesbergen and van Luit (2003) used the title “Mathematics Interventions for Children with Special Educational Needs: A Meta-Analysis” (Kroesbergen & van Luit, 2003, p.97). However, this could be misleading to readers who do not check the

inclusion/exclusion criteria, since their working definition of special educational needs included “low performing or at risk; learning disabilities; mild or educable mental retardation; mixed groups or other disorders, such as behaviour or attention disorders” (Kroesbergen & van Luit, 2003, p.101).

In the UK, special educational needs as a phrase also has practical and policy implications as teachers are increasingly monitored for value added performance and schools struggle for funding. For example, a study of SENCOs in England found that they expected to have to stand up for pupils more in the future than they did at the time of asking (Pearson, Mitchell, & Rapti, 2015). This is a shame, since a truly inclusive classroom should be one in which everyone’s needs are met as a matter of practice and so special educational needs should only be a concern where significant adaptations are necessary. Instead, the SENCOs in Pearson et al.’s (2015) study appeared to feel that this was not so much a value as an attempt at cutting funding to schools. In a good example of unintended policy outcomes, this appears to have increased the likelihood of SENCOs pushing for a label and ensuring that children have an Education, Health and Care (EHC) plan.

The predecessor to the EHC Plans, statementing of pupils and levels of assessment at School Action (SA) and School Action Plus (SA+) levels is still used informally, and starts to give a pragmatic definition of special educational needs based on the level of support required. This would classify pupils according to whether their needs could be met within a mainstream classroom with minor adaptations, significant support, or with some kind of intervention. These simple categories might be a contributing factor to the vague use of Moderate Learning Difficulties (MLD) as a phrase (Norwich, Ylonen, & Gwernan-Jones, 2014), since linguistically it suggests some kind of mid-point in the classifications.

Despite flexibility in how the term is used, Special Educational Needs has a legal definition in the UK. At a basic level, this includes disabilities as set out in the Children Act and Disability Discrimination Act. While the Children Act set out specific examples such as a child being “blind, deaf or dumb or suffers from a mental disorder of any kind or is substantially and permanently handicapped” (Children Act 1989, section 17.11), the Disability Discrimination Act (1995) simplified this by focusing on how effectively a person can perform daily tasks. This is essentially the same as the definition used in the Equality Act (2010).

To be defined as disabled requires two conditions: a substantial and long-term negative effect on one's ability to carry out everyday activities (Department of Education, 2014). Special Educational Needs as a concept draws upon this style because it looks at learning difficulties in the context of what provision needs to be made to reduce those difficulties. This defines a learning difficulty as a significantly greater difficulty in learning than peers or, as with the 'daily tasks' definition above, a disability which hinders use of educational facilities. Consequently, special educational provision means the support necessary to facilitate such access or to maintain progress with same-age peers. The definition also specifically excludes English Language Learners unless they qualify as having special educational needs for some other reason. Being unable to speak English but being capable of learning effectively in one's home language would therefore not qualify as having special educational needs. It was noted in the introduction chapter that such a broad definition would not be suitable in Saudi Arabia's medical model of SEN. The following two sub-sections therefore distinguish between studies in peer tutoring for pupils with emotional and behavioural difficulties, which would fit with the UK definition of SEN but not the Saudi Arabian definition, followed by a sub-section of studies which meet both countries' definitions.

2.9.1 Emotional and Behavioural Difficulties

As was noted in the introduction, some research into peer tutoring for pupils with EBD has pointed out the largely untested impact of gender (Geerlings, Cole, Batt, & Martin-Lynch, 2016). While there is a clear gap in the research in general, it may be largely irrelevant for Saudi Arabia where schools are strictly segregated by gender, with all government-funded schools being single-sex and rules on this being increasingly enforced in private and international schools. However, the assessment system in Saudi Arabia means that pupils may often be held back a grade if their exam performance is low, so studies pointing out the self-esteem repair value of cross-age peer tutoring (Mesler, 2009) might be more relevant in Saudi Arabia than in the UK. The same could be said of MLD, which is the focus of this study.

More generally, research in the UAE has suggested that EBD is poorly conceptualised in Arab states in much the same way as Norwich et al. (2014) criticised the definitions of MLD in the UK. For example, Khamis (2009) found an "alarmingly high" proportion, 56.5%, of pupils who could be thought of as having learning disabilities based on self-report and informal teacher assessments, giving a

strong prediction of EBD needs. The difficulty of addressing EBD in Saudi Arabia is therefore bound up in such issues of under-classification, which may manifest in a lack of guidance or resources or EBD becoming ignored if it is considered the norm.

Regardless of whether EBD is considered as part of SEN, development of social skills is often a key aim for those with SEN and so tends to be an outcome assessed in studies of peer tutoring with such pupils. For example, peer tutoring has been recommended to help develop self-control in specialist behaviour units (Bowman-Perrott, 2009). Reciprocal peer tutoring is similarly recommended for developing social skills (Spencer, 2006) or making classrooms feel more equal by restoring some pupil autonomy and decentralising the power of the teacher (Shogren, Bovaird, Palmer, & Wehmeyer, 2010).

However, it has also been noted that there is little guidance for teachers looking to implement peer tutoring in this setting (Walker, Clancy, Tsai, & Cheney, 2013). Similarly, descriptions of interventions for EBD pupils often treats those pupils as all the same, making it difficult for a practitioner to consider how EBD could interact with other factors such as additional learning needs, gender, or ethnicity (Ryan et al., 2004). The lack of guidance on implementing peer tutoring for EBD pupils in the context of Saudi Arabia has been highlighted as a significant barrier in Saudi Arabia's teachers trying the intervention (Abaoud, 2016).

2.9.2 Other special educational needs

Peer tutoring has been shown as effective in terms of correct spelling for pupils with speech and language disabilities (Burks, 2004), but, as with the research discussed in 2.8.1, this only gives a crude proxy for actual learning. For example, Burks (2004) also discusses how peer tutoring helped disabled pupils to better engage with tasks and so produce work which more accurately reflects their abilities. This is evident in peer tutoring of story mapping techniques which helped a group of pupils with speech and learning problems (Grünke et al., 2016), highlighting how these pupils' abilities were being underestimated because the assessment was not suitably differentiated. This further shows how peer-assisted learning can not only improve learning directly but can improve teaching by generating better data for teachers.

Implementations of peer tutoring with disabled peers generally seem to require more structure, such as emotional intelligence prompts when giving feedback (Burns, 2006). As with interpersonal relationships, it seems that emotional intelligence is both

a pre-requisite of effective peer-learning with disabled peers and something which is improved by peer-learning, thereby creating a virtuous cycle (Pellitteri, Dealy, Fasano, & Kugler, 2006).

Another highly structured peer tutoring approach, Use of Numbered Heads Together (similar to Jigsaw), was shown to improve the mathematics quiz scores for a group of disabled students, with one explanation being increased time on-task (Haydon, Maheady, & Hunter, 2010). Haydon et al.'s study highlights how it is important to look for explanations for improvements in peer tutoring research generally, but especially so when participants have special educational needs since there are so many barriers to learning it can be difficult to know which is being ameliorated.

As well as promoting general whole-school values of inclusion and diversity (Jellison et al., 2015; Jones, 2007), peer tutoring can specifically aim to address issues faced by certain groups of pupils with special educational needs. Noting an increase in pupils with autism in mainstream settings, a group of primary schools in England used peer tutoring to effectively reduce bullying of autistic peers (Bradley, 2016) in much the same way as peer tutoring was used to help teachers adapt to increased mainstreaming in the US (Anderson, Yilmaz, & Washburn-Moses, 2004). This approach is supported by an emphasis on autistic pupils engaging in peer learning in the early years setting (Guldberg, 2010), helping to both develop their social and communication skills and improve peer relationships at this vital early stage.

However, even here, the way in which values are assessed can lead to different conclusions. Klavina and Block (2008) found that peer interaction was mainly around instructional and physical interactions, with little change in social interactions during peer-assisted learning. This might be encouraging in terms of time on task, but it suggests that peer tutoring might not be as effective as is hoped in terms of encouraging social interactions between disabled and non-disabled peers.

Despite the widespread enthusiasm for peer tutoring, there are some cases of limited effectiveness for pupils with more profound additional learning needs, suggesting a need for caution. An experimental study using a range of peer tutoring interventions for pupils with severe reading disabilities found no statistically significant improvement after 10 weeks, concluding that more intensive and expert tuition was necessary for such pupils (Wexler, Vaughn, Roberts, & Denton, 2010). Similarly, while higher-order thinking has already been highlighted as lacking in peer tutoring

generally (Topping, Miller, Murray, & Conlin, 2011), this appears to be even more problematic in peer tutoring for pupils with disabilities (Morano & Riccomini, 2017). Nevertheless, there are examples where complex needs can be met through peer tutoring. For example, Giangreco (2007) shows effective peer tutoring for a disabled pupil five-years behind his peers. He had a developmental disability so was mentally at kindergarten level but still wanted to be present in a same-age peer group (5th grade). This was achieved by adapting learning objectives and creatively using overlapping curricula.

Other research has also shown that effective peer tutoring implementations in one context can be ineffective in another, particularly when special educational needs are present. For example, a similar approach to the effective implementation described in Tsuei (2011) was found to be ineffective for pupils with autism, while peer-learning more generally was only evaluated as showing "promise" (Finnegan & Mazin, 2016, p.187). Similarly, when looking at social behaviour, classwide peer tutoring was found to be ineffective for pupils with ADHD until peer coaching was added to the implementation (Plumer & Stoner, 2005).

One particularly interesting study looked at peer tutoring for wheelchair users in physical education classes, with situated learning and a communities of practice theoretical framework helping to show that pupils used peer tutoring to "make sense of their situations as wheelchair users" (Standal & Jespersen, 2008, p.208). This helps to illustrate the value of taking time to train tutors and for all participants to reflect on the tutoring process (Stenhoff & Lignugaris-Kraft, 2007). Similar conclusions were reached for visually impaired pupils in PE (Wiskochil, Lieberman, Houston-Wilson, & Petersen, 2007), although they also noted that untrained tutors were still effective to a lesser degree.

In terms of specific types of peer tutoring, CWPT has also been shown to help pupils with learning disabilities to better understand algebra (Impecoven-Lind & Foegen, 2010), although the study did not explore any reasons why this might be any more or less true for pupils with learning disabilities than for any other pupil. These findings support the earlier work of Butler (1999), who found that pupils with mild to moderate learning disabilities could benefit from engaging with a CWPT programme as measured by sight word recognition. Crucially, Butler also argued that benefits extended beyond reading and into other subjects, suggesting either improved

motivation in general or that a barrier to learning in other subjects had been overcome.

2.10 Summary of the literature and the questions the present study will address

Peer tutoring in its broadest sense is strongly associated with European and USA tradition, making it difficult to simply transfer into other cultures and settings (Andres & Barrios, 2006). Added to this, implementation of peer tutoring relating specifically to pupils with special educational or behavioural and emotional needs is likewise underpinned by principles of inclusion in the US and UK. While Saudi Arabia draws upon both curriculum content and educational policy from these countries, the context is clearly distinct. There is also very little in the research literature to guide practitioners who attempt to judge transferability or generalisability of studies from the UK/US context to Saudi Arabia.

It has also been shown that evaluation of interventions differs significantly based on the outcomes being measured, in particular whether social skills or personal and social development is foregrounded. Given the vast range of variations in peer tutoring, practitioners and researchers could find the literature overwhelming when seeking guidance. However, some generalisations can be made. Peer tutoring in general, and PALS in particular, has been shown to be highly effective for a range of social and learning outcomes in a wide range of contexts. There is strong evidence that, handled sensitively and with skill, these persist for pupils with SEN and EBD. However, there is currently a shortage of discussion regarding cultural adaptations, and even fewer which consider Arabic contexts and what kind of development might be needed for teachers. Based on all of the above, the reviewed literature has assisted in formulating the research questions for this study as related to evaluation into two parts:

Part One: Process and outcomes of peer tutoring programme (Maths PALS):

- What gains in knowledge about peer tutoring are evident for the trainee teachers of SEN pupils who have undertaken a preparatory peer tutoring course?
- To what extent do trainee teachers of SEN pupils implement peer tutoring programme (Maths PALS) according to expected guidelines in their teaching practice?

- To what extent does engaging in peer tutoring programme (Maths PALS) result in improvements in mathematics for pupils with mild intellectual disabilities (MLD)?
- To what extent does engaging in the peer tutoring programme (Maths PALS) result in positive changes in the attitude of pupils who have mild intellectual disabilities (MLD) towards mathematics?

Part two: Perspective on peer tutoring programme (Maths PALS):

- What perception do trainee teachers have of the peer tutoring programme (Maths PALS), its implementation and the outcomes for pupils and themselves?

Based on the literature review, the main distinction between this study and previous literature is that this study lies in its investigation of current levels of personal exposure to peer tutoring system, training with regard to the understanding and implementation of peer tutoring programme and a greater understanding of the benefits and limitations of utilising such a system with pupils who have been identified as having SEN in Saudi Arabia.

The next chapter will describe the methodology used in this study, including the instruments of data collection and analysis, in order to address the research questions.

3 Chapter Three: Methodology

3.1 Introduction

This chapter is concerned with a detailed explanation and justification of the chosen methodological approach adopted within this research. Cohen, Manion and Morrison (2013) contend that the choice and application of research methods is of critical importance within any study, as it informs the overall shape and direction of the research, and also informs the reliability and validity of the research outcomes. Patten and Newhart (2017) echo this view, confirming that unless the detail of the research methodology is carefully structured and planned, then there is a genuine risk of research falling short of expectation. There are, however, multiple aspects to consider when formulating and applying an appropriate research methodology, and according to Bryman and Bell (2015), all of these aspects must be sympathetic to one another and work towards the aim of achieving a response to the principal research questions and overall research aim and objectives. Accordingly, this chapter sets out in detail the practical actions undertaking in this research, and theoretical justifications for these, with reference to existing guidance in methodological literature. Consideration is given, therefore, to the philosophical assumptions of the research, the detail of the research design, which is presented in two parts, a detailed explanation of the research instruments, both quantitative and qualitative, and also an explanation of the data collection and subsequent analysis techniques. These explanations include a balanced discussion throughout, highlighting the recognised advantages and disadvantages associated with each aspect of this process, which demands that a researcher adopts suitable mitigation strategies when appropriate in order to limit and ideally eradicate known weaknesses in any methodological approach (Best & Khan, 2014).

As this research study adopted a mixed methodological approach, often called ‘mixed methods’ - that is to say, two distinct and discreet research approaches were utilised, one quantitative and one qualitative - the detail of each of these is discussed in turn, including an explanation of how each research approach was developed and then how it was applied, utilised, and analysed. Mertens (2014) notes that although there are some criticisms of mixed methods research, it is becoming increasingly popular in social sciences investigations, especially in education. Mertens (2014) further argues that not only do mixed methods studies provide precise

measurements arising from a piece of research, but also an understanding of why particular research phenomena occur, as it is not always possible to establish this from pure quantitative metrics. Moreover, Lester, Inman and Bishop (2014) argue that when employing established research instruments in novel situations such as the case in this research, it is important to be able to understand motivations and participant perspectives, as well as precise quantitative measurements. The application of each of the research instruments is therefore presented independently of one another before being synthesised in a discussion regarding the validation of mixed methods of research and subsequent triangulation. The use of primary data during the investigation demands rigorous ethical standards be upheld, and these are also discussed in the latter stages of this chapter, with particular acknowledgement of the potential risks and mitigations necessary when gathering primary data from children who cannot necessarily be considered capable of providing informed consent. The chapter concludes with a brief summary, reiterating the key points presented in the discussion, which then inform the results and discussion chapters which follow.

3.2 Methodological Approaches and Philosophical Assumptions

3.2.1 Research Aims and Research Questions

This research is framed within dual research aims which are both distinct and complementary to one another. In the first instance, the research can be considered to have explanatory aims as it strives to evaluate the effect of the mathematics peer tutoring programme, PALS (Peer Assisted Learning Strategy), and on the other hand, an interpretive aim in terms of understanding the experience of the Maths PALS for both students and trainee teachers. This demands a multiphase approach to the research, treating each aspect of the research aims individually and then synthetically in order to fully appreciate the impact of the Maths PALS from multiple user perspectives. Accordingly, the research questions themselves regarding both the explanatory and interpretive aims are also divided into two distinct sections. The first section is thus concerned with trainee teacher knowledge of peer tutoring and its administration measured in terms of attainment in mathematics and attitudinal gains. This is specifically focused on the experiences of trainee teachers and maths pupils with Special Educational Needs (SEN), adaptations for which are discussed during the course of this chapter. The second part is concerned with the trainee's

perceptions of the approach which was also assessed. Thus, the research questions are:

PART ONE: process and outcomes of the peer tutoring programme (Maths PALS):

1. What gains in knowledge about Peer Tutoring are evident from the trainee teachers of SEN pupils who have undertaken a preparatory peer tutoring course?
2. To what extent do trainee teachers of SEN pupils implement peer tutoring programmes (Maths PALS) according to expected guidelines in the teaching practice?
3. To what extent does engaging in the peer tutoring programme (Maths PALS) result in improvements in mathematics for pupils with mild intellectual disabilities(MLD)?
4. To what extent does engaging in the peer tutoring programme (Maths PALS) result in positive changes in attitude pupils who have mild intellectual disabilities (MLD) towards mathematics?

PART TWO: perspective on the peer tutoring programme (Maths PALS):

5. What perceptions do trainee teachers have of the peer tutoring programme (Maths PALS), its implementation and the outcomes for pupils and themselves?

The research questions within Part One clearly focus on an explanatory approach seeking a quantitative response from trainee teachers (questions one and two) and pupils with SEN (questions three and four). The responses to these questions can be presented in exact quantifiable terms, which can themselves be interpreted with reference to wider benchmark analysis to demonstrate the impact of Maths PALS for trainee teachers and pupils with SEN in a novel cultural context. The research question within Part Two lends itself to an interpretive approach seeking subjective opinions on the part of trainee teachers with regards to their experiences of the Maths PALS utilised with SEN pupils in a novel cultural context. Adopting a multi-perspective and mixed methods approach in this manner provides a comprehensive overview and understanding of the multiple benefits (or otherwise) of adopting the Maths PALS for children with SEN within Saudi Arabia.

3.2.2 Philosophical Justification for Mixed Methodologies

As the research aims and questions quite clearly demand alternative methodological approaches, it is important to explain why this was considered appropriate, and also to explain the philosophical justification for this approach. With regard to Part One, the quantitative element, this is classified as a scientific quasi-experimental design on the basis that an existing research methodology is utilised and it is one which has proven efficacy in seeking to measure attitudinal outcomes on the part of pupils and also teachers, trainee or otherwise. With regard to Part Two, this demands a more flexible approach in order to understand subjective perspectives which are equally important in terms of individual teachers personally interpreting and then reliably applying the Maths PALS in a working setting.

Stage and Manning (2015) and Creswell (2013) both contended that the use of mixed methodologies or multi-methods of research is not new. Both demonstrate that this principle can be found as far back as the 1950s, although it has long continued to attract debate, principally because there are strong arguments demonstrating that each typology of data and also methodological approach attracts its own inherent logic which by its own definition cannot be easily synthesised (Johnson, Onwuegbuzie & Turner, 2007). In more straightforward terms, alternative forms of research logic set on alternative ends of a logical spectrum make it impossible for them to be reconciled in the opinion of some research scholars. However, in counterpoint to this, it is also argued that whilst in an academic sense it is understandably attractive to seek to examine research phenomenon in isolation using distinct and defined research methods (Creswell, Plano, Clark, Gutmann & Hanson, 2003), this is not necessarily a practical or realistic reflection of human nature and behaviour (Tashakkori & Teddlie, 2010).

Those who support mixed methodos of research, such as Creswell (2013) and Tashakkori and Teddlie (2010), argue that the application of multiple complementary or sympathetic research methods is superior in terms of understanding the complete nature of the problem and its outcomes. Johnson & Onwuegbuzie (2004: 16) present a straightforward definition of mixed methods research, describing it as "*the combination of quantitative and qualitative approaches*". They go on to argue that it is a superior approach because the respective strengths and weaknesses of each offset the other. There are a number of forms of evidence for this which can be summarised thus:

- Quantitative research often fails to provide insight into the context of participant responses, leading to a lacuna in understanding of the relative contextual meaning, and worse, leading to flawed conclusions due to the absence of contextual knowledge and potential assumptive explanations which may be made in their lack. Conversely, qualitative research is disproportionally exposed to the potential of inadvertent subjectivity on the part of the researcher, which can be offset with the inarguable and factual representation of quantitative data.
- Pragmatically, mixed methods of data collection afford the researcher the opportunity to use the full range of research tools available to them. By freeing the researcher from the restrictions associated with purely quantitative or purely qualitative methodological techniques, it enables a researcher to develop a suitable research methodology which truly examines the full remit of the research issue.
- Mixed methods research answers complex questions which cannot be categorised under a mono-mode approach. It allows for the full scope of issues associated with the research questions to be examined, measured, and contextualised thereby preventing the inherent flaws or weaknesses associated with a single methodology.

Tashakkori and Teddlie (2010) assert that mixed methods have gained traction, particularly in the last 15 years as there has been a rapid increase in globalised research which applies traditionally or established Western research models in alternative cultural settings. Rubin and Babbie (2016) reveal that this has demonstrated the importance of mixed methodologies as it has brought to the fore a number of subtleties with regard to applying Western methods in other cultural settings which would not have been immediately apparent using a pure quantitative or pure qualitative approach. Frels and Onwuegbuzie (2013) explain that because of the inherent assumptions associated with particular cultural mindsets in terms of research philosophies and their subsequent justification, then the adoption of mixed methods from a philosophical perspective when applied within a novel practical context help to ensure that the full scope of the problem is examined in depth.

3.2.3 Pragmatism

Morgan (2014) argues that first and foremost, a mixed methods approach to research can be considered as practical, leading to the positioning of mixed methods research under the philosophical guidance of pragmatism. Hammond (2013) supports this argument, highlighting that a further benefit of mixed methods research is that it enables those researchers who adopt a pragmatic perspective to bridge the gap between purely quantitative and purely qualitative perspectives, a gap which in the opinion of Glogowska (2015) is often unnecessarily adversarial. Tashakkori and Teddlie (2010) and Feilzer (2010) are equally firm supporters of this pragmatic view, especially when seeking to apply established research instruments in novel cultural settings, because understanding an established research problem from a new perspective often provides valuable insight and creates the foundation for transferable knowledge, something which is equally useful to academics and practitioners. In this particular study, categorised as a fundamentally scientific methodology, it brings together both traditional and novel perspectives meaning that in real terms, pragmatism is the only sensible philosophical position to adopt. This is established from the development of the research questions which utilise a number of established research instruments positioned in a novel context, which is in turn synthesised with novel research questions in a novel context. The point is to understand an established problem - attitudinal improvement in maths teaching for pupils with SEN - from an alternative perspective.

Given the ongoing criticism of pragmatism from those methodological experts who support a purist view, it is important to discuss the assumptions about truth in pragmatism and also the matter of usefulness. The fundamental challenge is that there is no simple explanation or definition of truth within pragmatism, and indeed, truth is of itself a concept which can only be centred on the individual and their relative epistemological reality (Biesta, 2010). Dillon, O'Brien and Heilman (2000: 14) for example, recognise that whilst the abstract definition of truth is "*an idea which must copy reality*", truth is of itself a relative concept. Not only is truth mutable, in that an individual can have their truths challenged as circumstances change or new knowledge comes to light (Biesta, 2010), truth is also contextual (Strube, Yost & Bailey, 1993). Again, this has relevance within this study given the importance of applying established Western research instruments in a novel contextual setting. Whilst it would not be anticipated that there would be wildly different views and

perspectives arising from this, there are still likely to be differences, meaning that different interpretations of truth, each equally valid to the individual concerned, will emerge. This is in part why it is so important for this study to utilise mixed methods which seek precise quantitative measurements, but utilise inductive enquiry through a flexible qualitative approach to understand such relative truths, as they are equally important even if they are different.

Hookway (2002), however, argues that these differences point to the criticisms of the application of truth in pragmatism, insofar as there is confusion between absolute truth and epistemology. There is also confusion between absolute truth and relativity, in the sense that what is true and relevant to one individual can simultaneously be neither true nor relevant to another (Hookway, 2002). Misak (2002) argues that pragmatism merely points to an indicator of truth, and it cannot be considered as absolute truth, as to extrapolate from an indication is not the same as saying that truth exists.

In counterargument to this, Hope and Waterman (2003) suggest that this same argument could be applied to any other methodology, given that no quantitative method is without its own inherent flaws, and neither is a purely qualitative approach. For example, statistical reliability can still be subject to errors, and encourages a very specific way of thinking which can omit wider relevant details, and furthermore, statistics still require interpretation (Morgan, 2007). Likewise, a purely qualitative view within a contextual grouping is also likely to be subject to its own flaws and biases, whereby discourse within such groups is mutually self-affirming and is thus true to those involved, even if it is inherently flawed to those outside (Bridges, 1999). In more straightforward terms, whilst there are indeed philosophical criticisms of the presentation of truth within a pragmatic context, it is also fair to suggest that no single philosophical positioning is without its own criticisms of truth, and the adoption of a mixed methodology is perhaps most effective way of mitigating such criticisms due to the counterbalancing effect of multiple methodological applications.

3.3 PART ONE: Scientific / Experimental Methodology

This section of the chapter is concerned with a detailed explanation of the quantitative aspect of the research, specifically the scientific/experimental methodology utilising pre-and post-testing for trainee teachers and pupils. It sets out the philosophical assumptions which underpin this technique, an explanation and

verification of the experiment design, details of the independent and dependent variables, details of the participants, and details of the application of the Maths PALS from a pupil perspective and also from a trainee teacher perspective. It also explains the data collection instruments, the detail of the data collection process, fidelity of the treatment, and also the advantages and disadvantages associated with the statistical tests used to analyse the data in the questionnaire once it had been administered and the data collected.

3.3.1 Philosophical Assumptions

The quantitative aspect of the research is underpinned by explanatory aims seeking to evaluate the effect of the maths PALS programme utilising a pre-post approach, one recognised in methodological literature (Creswell, 2014). One case is that of pupils, which has an experimental design and their attitudinal and attainment gains are pre-post tested using a controlled trial. In the case of trainee teachers, their application is measured differently as will be described later in the chapter. In each instance however, all aspects of performance are measured and the explanatory purpose of the research is to generalise from these cases using defined measurements. The research questions (1 – 4) all demand experimental methodologies seeking a response to generalised cause-effect relationships. In this sense, it can be suggested that the research questions as based on processes and outcomes operate at two levels. At class student level, they are generalised causal research questions using an experimental design, but at trainee teacher level they are concerned with associations and correlations which are partly descriptive but in each instance generalised case response is sought.

At a fundamental level, experimental or more accurately quasi-experimental research occurs when a researcher actively manipulates a single variable in order to understand the nature of cause-and-effect relationships (Creswell, 2014). In this instance, there is the temporal aspect in that cause precedes effect and it is the strength and nature of this effect which is under investigation. Marshall and Rossman (2014) explain that there is some disagreement amongst academics in this field over the use of empirical data in order to understand the epistemological perspectives, with on the one hand some scholars favouring the testing of an *a priori* philosophical position, such as occurs when deliberately seeking to test the impact of variables. Others, however, such as Dalbauer and Hergovich (2013), disagree with this approach, as they argue that this influences the findings and the way in which data

is interpreted either at a scientific level, for example the choice of variables to be analysed, or setting of various levels of significance. This is crystallised in a principle referred to as the Knobe Effect which is commonly understood to be a human predisposition that changing things will invariably have negative outcomes, and any good changes are merely happy accidents, not positive will loosely related to the idea of locus of control. In this instance the Knobe Effect can lead people to unintentionally misinterpret any data which is borderline as being negative, not positive, so this is about self-awareness (Roberts & Knobe, 2016). However, as noted, in regard to the discussions of mixed methods of research and the application of relevant philosophical principles it is generally agreed that well designed quasi-experimental research techniques strike a balance between abstract theoretical ideals and pragmatism in terms of access and feasibility (Creswell, 2013). As this investigation is undertaken under the pragmatist philosophical stance, then these philosophical assumptions are considered reasonable.

3.3.2 Experiment Design

Experimental design: Testing of the Maths PALS, as described above, uses a quasi-experimental design which involves the deliberate manipulation of variables. In this instance, the selection of two groups of pupils, one control and one test, and utilises pre-testing and post-testing to measure the effect of the manipulation, in this instance being the intervention of the Maths PALS. It is recognised that pretesting can sometimes influence the effect (Roberts & Knobe, 2016), but the circumstances of this depend on the specifics of what is being tested and also the nature of the participants who may recognise the pretesting for what it is. In the case of young children with SEN, this was considered to be unlikely, particularly as they were not in any way familiar with Maths PALS as it is not widely utilised within schools in Saudi Arabia at the current time.

When utilising an experimental design, one of the main practical issues to consider is the involvement or sampling in each of the research groups; that is to say, how will individuals be identified to take part and how can there be confidence that they are representative sample, particularly when seeking to draw generalised conclusions from the findings (Campbell & Stanley, 2015)? In practice, it may be unfeasible to gather data from all possible research participants, necessitating the selection and identification of appropriate control and test groups. Westfall, Kenny and Judd (2014) contend that if possible random sampling is to be preferred if it is impossible to

measure the entirety of the population sample, although William, Shadish, Cook and Campbell (2002) highlight that it is also important for a researcher to understand the limitations of their proposed population and be prepared to provide a justification to this typically on the basis of defined characteristics. These issues are discussed in depth in relation to the selection of participants described in *Section 3.3.5*.

At the generalised level, however, the participants were those who were available to take part in the experiment and who volunteered to participate (trainee teachers). This was undertaken via the random assignment of the available 10 trainee teachers (who matched in their grade point average GPA) to 2 groups, (i) non-PALS i.e. control, and (ii) Maths PALS. The GPA system will be described in section 3.3.5. Having matched them by their GPAs, by ranking them 1 to 10, they were paired (1 and 2; 3 and 4; 5 and 6, and so on) and then assigned to each group on a wholly random basis, by toss of a coin. A coin was flipped for the odd-numbered participants ranked by GPA, heads for PALS and tails for non-PALS, and then assigned the paired even-numbered participants to the opposite group. This was further influenced by access to the schools which were able to provide practical work experience during the course of teacher training. Also the availability of people classes where the pupils had MLD, who were selected by the trainee teachers on the basis of the availability of the classes within the schools at times which fitted within their training programme.

Extraneous variables: Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf and Shadish (2013) comment that one aspect which is often unavoidable in any experiment of this nature is control over extraneous variables. To some degree, any experiment is exposed to random error of this nature, referred to as Type I and Type II errors in literature - that is to say, because of the random selection of participants it is possible that an effect is found which is not a true reflection of the distribution over the entire population sample (Type I), or the converse, that no significance is found when it in fact exists, and therefore the relationship is not noticed when it should have been (Type II). Unfortunately, this is an issue which all experimental studies are subject to, and one which it is the responsibility of the researcher to seek to control as much as possible (Kratochwill et al., 2013). In this instance, this was achieved by random assignment of trainee teachers to the control and experimental groups which was a decision made before the experiment commenced and other control procedures included the use of pre-testing and post-testing, and also covariate analysis as part of the statistical testing process.

Pre-test and post-test: Dalbauer and Hergovich (2013) demonstrate that the application of pre-test and post-test measurements provide a clearer reading of research outcomes rather than using post-test in isolation. As described previously, the specifics of the research population and nature of the testing method meant that there was limited concern in this experience as regards the capacity of pre-testing to have an effect in itself, however it is recognised that there are other disadvantages associated with the application of pre-testing. These include time and effort necessary to administer the tests (Robson, 2011), a pragmatic issue which may in some instances be unfeasible. Other issues have been shown to include increasing the participant expectations of the outcome (Roberts & Knobe, 2016), influencing the experimental treatment, i.e. it is no longer truly experimental because there is now some awareness of the process and this experiment is not seeking to measure that effect of itself (Hofmann, Adriaanse, Vohs & Baumeister, 2014); and, as referred to previously, the scores may also affect post-test outcomes because the participants can begin to anticipate the questions based on their experience of the pre-test. Whilst this may be a possible issue for the trainee teachers, it was not considered to be a significant concern for the pupils. However, given the nature of this particular study and also the preceding use of the research instruments (discussed in depth in *Section 3.3.8*), the advantages of utilising pre-test were considered to outweigh the disadvantages, largely on the basis of the nature of the research population and the type of study being undertaken.

Covariate: Creswell (2014) notes that a covariate is best understood as a variable which is controlled by the researcher for the purposes of statistical analysis, and that the covariate must have the character of relating to the dependent variable but not relating to the independent variable. In this instance, it was necessary to control for age of the pupils which has the potential to covariate with the dependent variable (attitudinal outcomes). The statistical process itself involves analysis of the covariance and the extent to which the scores are adjusted, making it possible to account for the level of covariance. The purpose of this exercise is to ensure a like-for-like comparison between the pupils with intellectual disabilities between the experimental group and the control group - principally because in younger children there are recognised markers of attitudinal and educational development loosely associated with age (McClelland, Acock, Piccinin, Rhea & Stallings, 2013). Especially in younger children, it is usually the case that any tests conducted with

pupils more generally, irrespective of whether or not they have intellectual disabilities, is accounted for by the month of their birth as well as the year. Specific age in months as well as years is shown to have a noticeable effect, especially on children who are considered to be 'young' for the school year and therefore may have had up to 9 months less developmental opportunity (McClelland et al., 2013). Therefore, using age as a covariate enables researchers to control the potential influences that may affect the dependent variable, i.e. attainment outcomes.

Manipulating treatment condition: In this experiment, two conditions were manipulated with an intervention model of individual with experience - that is to say, something different in the experimental condition than in the control condition. This is reflected in the detail of ***Figure 3.1*** below.

Pre-test and Post-test Design Time

Select Control group	Pretest	No Treatment	Posttest
Select Experimental group	Pretest	Experimental Treatment	Posttest

Figure 3.1:Quasi-experimental Pre-test and Post-test Design (Creswell, 2014: 336)

Marczyk, DeMatteo and Festinger (2005) refers to this experimental process as a non-equivalent comparison group design employing a pre-test-post-test format. In more straightforward language as that used by Creswell (2014) it can be considered as a quasi-experimental configuration with a control group. The initial phase comprised the collection measurement from the date of half of the trainee teachers (who formed the Maths PALS group) as to the extent of their knowledge of the peer tutoring programme pre- and post-training course on peer tutoring (sub-section 3.3.8.1 considers how these data were collected in much greater details). Having undergone this assessment and training process 5 of the trainee teachers implemented a peer tutoring programme to their mathematics classes (Maths PALS). The remaining participants had no training course on peer tutoring and had no assessment, and continued to utilise conventional teaching methods in their mathematics lessons as the control group. The duration of the entire study was three months and the students with intellectual disabilities in the experimental group and the control group were both tested prior to the beginning of the three-month teaching period by the trainee teachers in order to assess their attainment in mathematics and their attitude to mathematics (details of these tests will be presented in later sections 3.3.8.2 & 3.3.8.3). The same pupils were retested by the research assistants at the conclusion of the course.

The pretesting of the trainee teachers in the control and experimental groups was important to understand the depth of knowledge regarding peer tutoring, as the purpose of this process is to enable the researcher to make observations about the effectiveness of the children for trainee practitioners, whether the implementation strategies within the classroom correspond with their training, and whether their impressions of the delivery of the programme represent an accurate reflection of pupil response. Quantifying these aspects is necessary to appreciate the value arising from the application of Maths PALS as an educational aid, which is one of the

objectives of the study. The pre-testing of pupils is more straightforward, as the purpose of the exercise when the experiment was completed was to ascertain the level of mathematics attainment on the part of pupils and also attitudinal attainment - i.e., pupils know more, and are more comfortable and confident in mathematics lessons. The trainee teachers were therefore tested on peer tutoring immediately prior to undertaking the peer tutoring course and then retested two weeks after completion of the training course to ascertain their responses. This delay of two weeks helps to mitigate some of the potential issues associated with pretesting described above. The timeframe for administering the training and measurement tests is provided in ***Appendix 1***.

3.3.3 Independent and Dependent Variables

The independent and dependent variables were concerned with the direct comparison of conventional methods for mathematics teaching, and the Maths PALS methods for mathematics teaching (control and experimental group of trainee teachers). This was supported by a comparison of the conventional methods for mathematics lessons as compared to the experiences of Maths PALS from a pupil perspective, as measured using the well-established instrument WRAT-4 maths subtest. This uses quantitative approaches to identify participant scores with regard to attitudinal development and learning of mathematics. Therefore, the variables were:

- **The type of group:** experimental group/control group
- **Total scores on the WRAT-4 maths subtest at Time I** (pre-intervention) test administered prior to the programme
- **Total scores on the WRAT-4 maths subtest at Time II** (post-intervention) test administered post the programme
- Total scores on the attitudinal questionnaire regarding learning maths at Time I (pre-intervention), test administered prior to the programme
- Total scores on the attitudinal questionnaire regarding learning maths at Time II (post-intervention), test administered post the programme
- **Additional continuous variable (age),** which as discussed previously, is defined by Pallant (2007: 90) as the "*variable that we suspect may be influencing scores on the dependent variable*"

These variables can be classified as two independent variables, one dependent variable and one covariate variable, as follows:

- **Independent variable:** one categorical independent between subjects variable with two conditions: experimental group/control group
- **Independent variable:** one categorical independent within subjects variable with two levels: Time I / Time II
- **Dependent variable:** one continuous dependent variable (scores measured at each time period)
- **Covariate variable:** one covariate variable (age)

In the specifics of this research, the pupils in both sets (experimental group/control group) were measured at the beginning of the three-month teaching period, i.e. at Time I (pre-intervention) by the trainee teachers, in order to assess their attainment in mathematics and also their attitude to mathematics (sub-sections 3.3.8.2 & 3.3.8.3 consider these tests in details). The pupils were then retested by the research assistants at the conclusion of the course i.e. at Time II (post-intervention).

With regard to the covariate variable, age, it was identified that this variable may well be influencing the outcomes, but unfortunately because the trainee teachers selected their classes and the pupils, it was not possible to assign the variable equally experimental and control groups. Creswell (2014) recognises that this may be an issue, and explains that researchers must take care to select and control their covariates to avoid additional unintentional effects on the dependent variable.

3.3.4 Setting

The research was undertaken in two state primary schools in Riyadh, Saudi Arabia. The schools were selected by the Special Education Department in the University to undertake practical work experience as a component of the bachelor's degree in teacher training during the period September to January 2015. The schools' curricula were amended in areas such as mathematics and reading to support pupils with moderate learning difficulties and additional provision was made for the MLD pupils to be taught in separate classes, which is normal practice within Saudi Arabia.

3.3.5 Participants

As noted previously in *section 3.3.2*, it is important to understand the characteristics of the participants in order that there can be confidence in their selection as

appropriate participants for a research study related to the aims and questions of the research. Therefore, it is necessary to give some consideration to the specifics of the participants involved within this study.

Trainee Teacher Participants: For the purpose of this study, trainee teacher participants were defined as "*a trainee or student teacher as an adult who is undergoing further training in order to become a member of the teaching profession through gaining formal qualifications*." (Claxton 1990: 16). Claxton (1990) further notes that different learning and teaching methods and attitudes vary according to individual trainee teachers. The unspoken implication being that it is sensible to illustrate a range of teaching approaches to trainees in order that they can determine those with which they are most comfortable, and/or which are the most effective relative to pupil needs.

Within the context of this study, a teacher training course is a compulsory component of the bachelor degree in special education within Saudi Arabia. Trainee teachers who complete the theoretical part of their degree are required to undertake a period of teaching practice over a four-month period in a functioning classroom. Trainee teachers will be introduced to different teaching methods during the course at university, however, these different methodologies did not include peer tutoring. Accordingly, it was considered that this stage in a trainee teacher's career is an optimum and natural environment to introduce peer tutoring strategies, specifically, Maths PALS which are not currently in use within the educational curriculum within Saudi Arabia.

The study was initially undertaken with a group of 21 trainee teachers. This number dropped to 10 due to various reasons: a failure to complete the necessary courses (modules); a lack of interest; and the difference in teaching environment, for example kindergarten teachers who were not applicable to the research sample. The remaining 10 trainee teachers were graded according to their educational attainment in theoretical development, from the highest achievers of the top to the lowest achievers at the bottom using a grade point average (GPA) system. This is a system of judging performance calculated by average of the letter grades earned in university, following a scale ranging from 0.0-5.0. GPA is calculated by dividing the total amount of grade points earned by the total amount of credit hours attempted.

The teachers were then paired and a random sampling approach was applied to decide which trainee in each pair went into the control group and which went into the experimental group, i.e. non-PALS or PALS. This was applied to the entire list, giving two entirely randomly selected groups using a stratified sampling approach (summarised in ***Table 3.1***)

Non-PALS Group		**PALS Group**	
Trainee Teacher	**Grade Point Average (GPA)**	**Trainee Teacher**	**Grade Point Average (GPA)**
Seta	4.74	Amal	4.82
Wadha	4.72	Abeer	4.38
Afraa	4.08	Afnan	3.72
Shaden	3.26	Noura	2.53
Ashwaq	2.35	Nada	2.51

Table 3.1:Trainee Teacher Participants Summary

Once allocated to the control or experimental group, the 5 trainees who formed part of the experimental group were initially tested in their knowledge of peer tutoring prior to the training course and these trainees were then retested two weeks after completing the training course; following this retesting, they were involved in implementing the Maths PALS programme as part of the mathematics education of pupils with MLD over the three-month period (October 2015 - December 2015). The remaining 5 trainees within the control group had no training in peer tutoring, were not tested in the knowledge of the tutoring, and continue to utilise conventional methods for teaching mathematics lessons. Both the control and experimental trainee teachers were trained in the administration of the WRAT-4 maths subtest and the attitudinal questionnaire involved in the latter element of the experiment.

The two groups of trainee teachers, control and experimental, went to each of the two state school described above in *Section 3.3.4* and visited both and selected the classes which they were interested in teaching, which is in accordance with the university educational training program. The trainee teachers within the experimental group selected five classes, Grade 3, 4 and 6 from the first state school, and Grades 4 and 5 at the second state school. The trainee teachers in the control group also selected 5 classes: Grade 2, 3 and 6 from the first state school, and Grades 1 and 2 from the second state school. To an extent, this may be said to represent a

contamination risk, because the researcher had control and experimental classes in the same schools, however it would have been entirely impractical to test students in complete isolation from one another. This is summarised in ***Figure 3.2*** below.

Mild Intellectual Disabilities Pupil Participants: The pupil participants with mild intellectual disabilities were female and aged between 7 and 15 (***Table 3.2***). They had previously been assessed by the schools as having mild intellectual disabilities by means of a multi-disciplinary team of experts concerned with child development. This included a number of complementary assessments as follows:

- Stanford Binet Intelligence Scale (5th Ed)
- Weschler Intelligence Scale (5th Ed)
- Porteus Maze Test
- Raven's Progressive Matrices Test

In addition to functional and social skills measurements as identified and measured by the Vineland Adaptive Behaviour Scales (2nd Ed).

The over-arching purpose of such comprehensive testing and assessment is to ascertain the day-to-day and also long term needs of pupils on a number of different dimensions to form a detailed overview of their capabilities and competence.

In light of these measures, a school curriculum was designed in areas such as mathematics, leading to suit their needs with provision being made for MLB pupils to be taught in separate classes. Five classes of 26 pupils formed experimental group, and five classes of 27 pupils formed control group in both the experimental group and the control group were tested prior to the beginning of the three-month teaching period by the trainee teachers in order to assess their attainment in mathematics and also their attitude to mathematics. At the conclusion of the course, they were then retested by the research assistants. ***Figure 3.2*** provides an illustration of the grouping.

School	Grade	Control group		Experimental group	
		N	Age	N	Age
1	1	6	8,7,8,8,7,7		
1	2	6	9,8,11,13,13,8		
1	3			4	10,11,12,10,11
1	4			6	11,14,13,13,13,12
1	6			4	15,13,14,15
2	2	6	9,7,8,8,10,9		
2	3	4	10,11,11,13		
2	4			6	10,11,11,11,9,10
2	5			6	15,12,12,12,12,12
2	6	5	14,15,12,15,14		
Total		**27**		**26**	

Table 3.2:MLD Pupil Participants

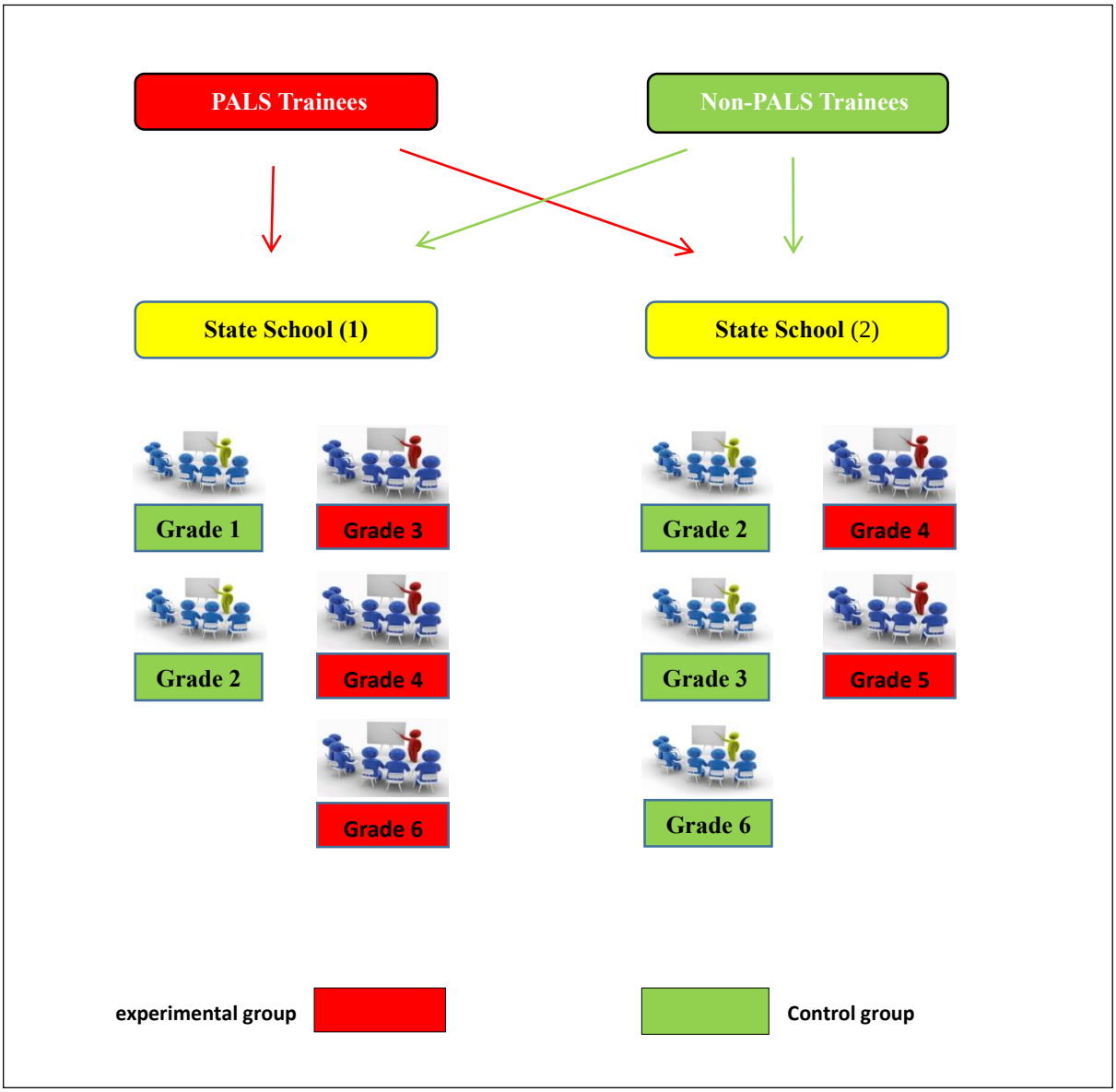

Figure 3.2: Grouping of experimental and control teacher training and pupil participants

Visiting tutors and research assistants: Visiting tutors are teaching assistants who help professors with the delivery of the courses at the University and who also serve as consultants to the trainee teachers on placement for the duration of the study. Visiting tutors implemented the PALS checklist via structured observation with the experimental group four times over the period the implementation of the Maths PALS to check the fidelity.

Research assistants are involved in the University for the purposes of assisting academic research. They were involved in data collection to reassess the MLD pupils in both sets (experimental and control groups) using the WRAT-4 maths subtest and the attitude questionnaire at the conclusion of the period of implementation. They

also implemented the PALS checklist observation eight times over the period of the course.

In total, 2 visiting tutors and 2 research assistants were employed for observation purposes. All completed a Maths PALS workshop and were trained in Maths PALS observation techniques. In addition, the research assistants had training on how to administer the WRAT-4 maths subtest and the attitudinal questionnaire.

3.3.6 Maths PALS Programme (Peer Assisted Learning Strategies)

The Maths PALS material was purchased directly from the American organisation responsible for its development in order to be used within the study. Before the Maths PALS can be implemented it is necessary for any individual utilising the programme to undertake a training course to ensure consistency and accuracy in its utilisation. For this study training was delivered by an experienced US academic member of the PALS training organisation (Dr Sarah Powell) who delivered a six-hour training workshop in order to familiarise the researcher with the materials in order to demonstrate how to implement Maths PALS within the classroom. The next stage in the process was to translate the Maths PALS material into Arabic in order that it could be administered to pupils. This involved translating both the manual and the activities (game board). The challenging aspect of this process was designing templates for use for the game boards and this involved the use of a professional graphic designer.

The fourth step in the process was a pilot of materials within Saudi Arabia. Initially it was the intention to translate Maths PALS materials up to Grade 2 based on the knowledge of the researcher and the general Maths ability of the MLD pupils who study in separate classrooms within primary schools within Saudi Arabia. The researcher went to check the compatibility of the contents of the Maths PALS programme with existing schools' curriculum. The results of the pilot were valuable, indicating that it was necessary to translate the activities up to the first grade. It was clear that the kindergarten and first Grade content were applicable for the MLD pupils and that the PALS programme was compatible with the schools' programme. Another valuable aspect emerging from the pilot was the time necessary to administer the Maths PALS which would be between 25 and 35 min.

3.3.6.1 *Maths PALS Principles and Aims*

PALS (Peer Assisted Learning Strategies) evolved over a period of fifteen years during the 1980's and 1990s (Maheady, 2001). Doctors Fuchs, Fuchs and Simmons

worked in collaboration with local American school districts to create a peer mediated strategy encompassing a variety of peer tutoring methods. The programme initially focused on Grade One to Six students studying English and Mathematics (Maheady, Mallette, & Harper, 2006) and then extended further to both Kindergarten (Mathes et al, 2003a) and 1st Grade pupils to support early reading instruction (Mathes et al, 2003c), and to higher levels focussing on content-area instruction (Fuchs and Fuchs, 1999). The development of PALS came about in conjunction with the previously mentioned CWPT Juniper Children's Project (See chapter on 'Literature', pp.37-38) which employed the use of dyadic instruction (Calhoon & Fuchs,2003).

The methodology of PALS is such that learners are paired with differing levels of ability (one higher, one lower) in order to support one another and learn from one another during skills practice. Pupils worked collaboratively for a minimum of 90 minutes during the course of a week participating in language, reading and maths activities. The teacher's role during this period is that of supervision to ensure learner roles are alternated and provide further instruction if required.

The purpose of PALS as a reciprocal class-wide strategy as set out in the original graded 2-6 level programme is to increase strategic reading (Saenz, Fuchs, & Fuchs, 2005) (See chapter on 'Literature', p.39). Within Maths PALS, the roles assigned to learner pairs are that of 'coach' and 'player'. Learners are assigned a particular mathematics skill, with the more advanced member of the pair taking on the role of coach and assisting the weaker learner through a series of questions and a set correction procedure in order to guide the less capable learner through the activity. These roles are then reversed. Within PALS this procedure involves the use of a 'game board' along with prompts for the coach which are located on the left-hand side of the board and correspondingly the players' mathematics problems are displayed on the right (Fuchs, Fuchs, Yazdian, & Powell, 2002).

The aim of PALS is to both complement and supplement current curricula activity with the Maths PALS programme being employed twice or three times per week, providing individualised practice in skills that learners have not yet mastered (Calhoon & Fuchs, 2003). In this sense PALS enhances the teacher's existing pedagogy rather than introduces radically alternative techniques.

3.3.6.2 *Material*

Reference to Maths PALS manuals are enclosed in ***Appendix 2*** and ***Appendix 3.*** They also contain copies of the e-templates generated, as the Arabic version of the translation process of the PALS materials in order to provide the trainee teachers with the Arabic versions to utilise within their lessons. Developing an e-template made it easier for the trainee teachers to adjust the game boards as necessary to suit particular purposes relative to the learning capacity of the pupils with intellectual disabilities. This was appreciated by the trainee teachers as there can be notable differences in learning approaches required for pupils with alternative learning needs.

3.3.6.3 *Base Treatment*

As described previously, base treatment ensured that training teachers in the control group for students utilising the traditional curriculum established within Saudi Arabia as decreed by the Ministry of Education. The Ministry also allows for amended curriculum in areas, such as mathematics and reading, to suit the needs of the pupils, and the specific provision being made for SEN pupils to be taught in separate classes. Mathematics lessons are typically delivered to the entire class by a trainee teacher and involve opportunities for both collaborative and independent learning.

3.3.6.4 *Treatment*

Trainee teachers in the experimental group implemented Maths PALS for approximately 25 to 35 minutes three days a week in addition to the regular mathematics program decreed by the Ministry of Education in Saudi Arabia. It was utilised as a supplementary programme to the regular instruction and PALS incorporate reciprocal teaching by paring students with the classroom into dyads. Each dyad included one high and one low performing student as measured by previous attainment identified by the teacher, ranking students in the class from high to low based on their mathematical competence. Working in dyads, students asked questions and provide a corrective feedback to each other. Every four weeks the trainee teachers reassigned the dyads to increase children's exposure to different students.

3.3.7 Training

3.3.7.1 *Teacher's Training*

The training course involved preparation for the five trainees to utilise a Maths PALS programme during their teaching placement. Each of the trainees were provided with 6 hours of training in total split over 2 training courses. One session was three hours, regarding peer tutoring explaining its principles, theories, and models. The other was a three-hour workshop on the Maths PALS programme to provide trainee teachers with the skills necessary to introduce it within their training practice placement. Full details of this process are provided within the appendices (***Appendix 4***).

3.3.7.2 *Students Training*

The trainee teachers were provided with guidance for math lessons, the manual instructions, posters and PALS pocket folders, which were distributed to pupils during each Maths PALS session. During each Maths PALS session, pairs of pupils shared a PALS folder which held game boards, one used in each PALS session (***Appendix 2***). Two symbols appear on each game-board, and flag symbols to prompt students to switch roles and a smiley face symbol to prompt students to award themselves a smiley point on their point sheet. When students practice concepts in pairs, the tutor asks the tutee (pupil) questions (e.g. How many?). The tutee then responds to the question. The tutor provides feedback help from any mistakes using a correction procedure: e.g. 'stop - you missed that one. Can you figure it out?' (Wait for a few seconds). The tutor then helps the tutee to find the answer; she does not say the answer unless the pupil continually struggles (Fuchs et al, 2011).

3.3.7.3 *Support for Implementation*

Support for the implementation was provided by the trainees via the visiting tutors and two research assistants employed specifically for observation purposes, and also for retesting following the intervention (*Section 3.3.5*). The visiting tutors and research assistants both completed a 2-hour PALS workshop (details are enclosed in ***Appendix 5***) and they were also provided with a manual describing the PALS processes using the intervention. Furthermore, they were trained in PALS observation techniques using the checklist which was given to them before the programme started. As described previously, the research assistants observed eight sessions over the period with visiting tutors observing for sessions. The responses

from the observations were aggregated and calculated to confirm the reliability of the observation.

Furthermore, the research assistants were trained in the WRAT-4 maths subtest and also the attitudinal questionnaire necessary to quantify pupil attainment and attitudinal development with regards to mathematics in both the control and experimental groups. The research assistants supported the SEN students with retesting at the end of the three-month assessment period and all trainee teachers were supported by the researchers during all aspects of the programme as required.

3.3.7.4 *Student Pairing*

For the student dyads, the teachers rank ordered the students within their classes according to their mathematical competence. They then performed a median split and paired the top performing students from each pair with the next highest performing students from each half until the list of pairings was completed. Every four weeks, the pupil pairs were reassigned to increased exposure to different students. Within each session the stronger performing student performed as the coach or tutor first, and then midway through each session using the flag prompt, students switched roles. During each Maths PALS session, the pairs of pupils used the materials described in *Section 3.3.6.4*, copies of which are presented in ***Appendix 3***.

3.3.8 Data Collection Instruments

This section of the chapter is concerned with a detailed explanation and justification of the data collection instruments, comprising the questionnaire distributed to trainee teachers in order to assess their knowledge of peer tutoring, the application of the well-established WRAT-4 maths subtest, and also the attitudinal questionnaire distributed to the pupils regarding their reactions to mathematics. This section also discusses the detail of the checklist for fidelity applied to ensure consistency in situational observation. Copies of all of these are contained within the appendices.

3.3.8.1 *Test of Knowledge of Peer Tutoring*

The test regarding the knowledge of peer tutoring ***(Appendix 6)*** was developed by the researcher using a multistage process as advocated by Oppenheim (2000) and also by Tapia & Marsh (2004). The reason for this is to ascertain the reliability and validity of any novel research instrument. The aim of the test was to assess

knowledge of peer tutoring so as to investigate the knowledge of trainee teachers regarding peer tutoring, something which is not currently taught as part of the standard curriculum within Saudi Arabia. The development of the test to assess peer tutoring suitable to meet the specifications of the research comprised seven distinct phases as follows:

1. **Review of the literature:** A critical review of the existing literature was undertaken in order to ascertain the fundamental issues of peer tutoring in particular, including materials from the PALS workshop and PALS seminar undertaken by the US academic from the PALS organisation.
2. **Initial instrument draft:** The initial draft was developed from the literature review included a construct of the test and the trainee teacher's knowledge of peer tutoring issues operationalised through the completion of a closed, multiple-choice test. The number of correct answers were used to operationalise the level of knowledge surrounding peer tutoring.
3. **Peer reviews:** The draft research instrument was reviewed by colleagues of the researcher who attended the maths PALS workshop and seminar.
4. **Revised version:** The revised draft was discussed with the research supervisors to ascertain feedback regarding the clarity and relevance of the items in the test, and to ensure the items were appropriate for the respondents.
5. **Translation:** The test was first written in English and then translated into Arabic by an independent academic interpreter, and translated back into English by another interpreter who were unfamiliar with the English version of the test (double-blind back translation). As a result of this, some changes were made to the Arabic version in accordance with the comments in the feedback.
6. **Pilot study:** The instrument was refined and validated through a pilot study with three postgraduate Arabic students who attend the PALS workshop and five of the undergraduate students in Saudi Arabia. None of the participants in the pilot study were involved in the main research investigation, otherwise this would have constituted double counting (Field, 2013).
7. **The reliability and validity:** the reliability of the instrument was checked by the Cronbach’s Alpha which is designed to measure internal consistency and is regarded as a measure of scale reliability. In essence, it is designed to analyse the reliability of specific tests. It is generated by statistically comparing two sets of data, and is calculated based upon their differences (variants) and the number

of items involved. Once the calculation is completed, the value of Cronbach's Alpha is a number between 0 and 1 - the higher the number, the more reliable the test is regarded to be, thus implying that the two measures share the same influences and are therefore measuring the same thing. In this research study, the data that were collected from the pre-test for five trainee teachers (PALS group), the internal reliability was measured by using a 49 items multiple-choice test. Kline (1999) suggests that acceptable levels of alpha in intelligence tests fall between 0.7 and 0.8. As reliability of the items had fallen below the criteria, being measured at 0.344, it was therefore necessary to consider removing items that have loadings of low item-total correlations from the scale to improve the alpha value. Eight items were removed from this knowledge test to improve the alpha value and to meet the acceptable value of alpha in intelligence tests (refer to ***Appendix 7*** for statistics). The reliability was assessed by using a 41 items and the Cronbach's alpha, was .817 in this participants as shown in ***Table 3.3*** below.

Reliability Statistics

Cronbach's Alpha	N	N of Items
.817	5	41

Table 3.3:Reliability of Peer Tutoring Knowledge Test

The stages set out here are in accordance with established methodological literature regarding the development of novel research instruments (Gajewski, Price & Bott, 2015) and the process was carried out in a manner which produces a research instrument that delivers reliable and valid results. Oppenheim (2000) observes that when assessing attitudinal responses using a novel research instrument such is the case here, there may be some limitations in the scope of the research instrument, but a pragmatic counterpoint to this, Reeves and Marbach-Ad (2016) equally acknowledge that there is an implausibility in developing an excessively long research instrument for the purposes of a study such as this, especially when it is supported by other pre-existing proven research instruments such as those discussed below.

3.3.8.2 *WRAT-4 Maths Subtest (Wide Range of Achievement Test)*

As mentioned in *Section 3.3.2* regarding the quasi-experimental design of this research and the use of pre-test and post-test attainment and attitudinal development

of pupils in both the control and experimental groups, it was considered sensible to use the proven and established research instrument regarding the attainment of pupils. The WRAT-4 test has been used extensively in educational curriculum in both the US and the UK and has a very large body of existing empirical validation (Wilkinson & Robertson, 2006). Given that the aim of this research is to investigate peer tutoring rather than necessarily the actual development or otherwise of pupils, is a sensible therefore to use a proven, established and pre-existing research instrument specific to pupil development. Hence the utilisation of the WRAT-4 maths subtest developed entirely for the process of assessing pupil attainment in mathematics. It should be noted that other WRAT-4 tests exist specific to other core educational disciplines, but were obviously not relevant here.

The WRAT-4 maths subtest instrument comprises a two-phase approach, (i) pre-testing, and (ii) as previously described in *Section 3.3.2*, a subsequent test after the three-month application of the Maths PALS peer tutoring approach. I sought permission to include these test forms in the appendices, but this was not granted by the publisher.

As the WRAT-4 maths subtest was developed in English, it was necessary to engage in a translation process in order that it was possible to administer to pupils in Saudi Arabia. This comprised the five-step process as follows not dissimilar to the approach to developing and then translating the peer tutoring questionnaire:

1. Purchase the WRAT-4 professional manual (in English) to acquire the instrument and a sample of materials, including the test forms and a sample copy of the responsible.
2. Obtain permission to translate the WRAT-4 Computation subtest into Arabic. This included permission to translate the material reproduce 300 copies upon approval (***Appendix 8***).
3. Undertake the translation progress. This included a double-blind back translation with an individual academic expert in mathematics translating in the first instance from English to Arabic, then the translation was reviewed for further revision to make sure nothing was misinterpreted. Once the translation from English to Arabic was completed, the researcher using another academic expert in mathematics, who were unfamiliar with the English version of the test, to undertake the back translation. Once completed, this was forwarded to the publishers of WRAT-4 for their approval.

4. Incorporate feedback from the publishers regarding the back translation making changes as necessary, and resubmitting to the publishers who approved the final copy translation and authorised the reproduction of copies as per step two.
5. Pilot the translated copy of the WRAT-4 with eight MLD students in Saudi Arabia. None of the participants in the pilot study were involved in the main research investigation.

Again, the process followed here is in accordance with recommended methodological principles, and is a widely used approach it is considered to have been appropriate for this research.

3.3.8.3 *Attitudinal Questionnaire Regarding Mathematics*

The attitudinal questionnaire (***Appendix 9***) delivered to the students within the experimental and control groups both pre-and post-peer tutoring was adapted from the existing research questionnaire developed by Barber and Houssart (2011). This follows precisely the same format as the delivery of the WRAT-4 maths subtest as previously described in *Section 3.3.6.3*. Again, as recognised above, the utilisation of an existing approved research instrument is preferable principally to ensure validity and reliability regarding scale instruments. However, once the development of the questionnaire in the current study was completed, the reliability was checked. The process for development of the attitudinal questionnaire regarding mathematics was as follows:

1. Utilisation of Barber and Houssart's (2011) research instrument on the basis that this has a proven record of application due to its simplicity from a pupil perspective and proven efficacy in the research literature.
2. Adaptations were made to the original questionnaire in sections 1 and 2 of the instrument in order to suit the participants in the study with MLD. Eight items were added on the basis of extant literature using the same principle as development of the pupil's research instrument. Seven items in section 2 were omitted from the original research instrument for the same reason. Section three of the scale was also deleted as it was not applicable (it asks children to write and draw).
3. The revised draft was checked and verified by the research supervisors.

4. Once again, a double back translation was undertaken. This was relatively straightforward given the simplicity of the items and the needs of the research population.
5. The attitudinal questionnaire was piloted with 6 SEN pupils, and it was ascertained that of the eight additional items, it was preferable to delete five, meaning that in total three additional items were included in the revised attitudinal questionnaire.
6. The reliability was checked (***Appendix 7***): Utilising the scale with the students in both the intervention and the control group; they were assessed prior to the beginning of the three-month teaching period in order to assess their attitude to Maths. The Cronbach's Alpha reliability of this attitudinal questionnaire is shown in ***Table 3.4*** below. As highlighted previously, any reliability score for a study such as this must be above 0.7 in order to be acceptable; in this case, the score is .818.

Reliability Statistics		
Cronbach's Alpha	N	N of Items
.818	53	12

Table 3.4:Reliability Statistics– Attitude to Learning Maths

3.3.8.4 *Fidelity of Treatment (Checklist)*

Fidelity of treatment was ascertained using structured observation via checklist, referred to previously with regards to the research assistants and visiting tutors who collectively undertook 12 observations of the children are at the three-month study period. Structured observation is described by Treanor (2012: 3) thus:

> *"Structured Observation" is used in educational and other interactional settings to chart different forms of behaviour. It differs from participant observation and field notes in that it follows, as strictly as possible, a preordained observation "schedule".*

Treanor (2012) continues that it can be considered as a systematic quantitative method that involves the coding of participant behaviours - in this instance, trainee teacher and pupil responses - to transform qualitative data into quantitative data in a reliable and valid manner (Treanor, 2012). As previously, with regard to the

development and adaptation of the research instrument utilised in the study, a multistage process was undertaken as follows:

1. The checklist (***Appendix 10***) was adapted from Fuchs, Fuchs, Yazdian and Powell (2002) which, similar to reasons for selecting the WRAT-4 attitudinal questionnaire, is an existing approved research instrument relevant to the study at hand.
2. Piloting was undertaken using a revised version of the checklist involving the adaptation of three of the items and also the relevance suitable for teaching pupils with MLD.
3. A revised version of the checklist was prepared with one item amended (an additional procedure to suit the needs of the pupils a question) and one item was replaced. One item was also adapted regarding the implementation of maths procedures and their components relating to pupils working quietly which is not necessarily appropriate for these pupils with particular learning requirements.
4. Once again, a double back translation was undertaken.
5. In order to assist the professors and the teaching assistants with utilising the checklist, a practical workshop was prepared with regard to training the observers about how the checklist should be applied in order to ensure consistency and accuracy in its application ***(Appendix 5)***. This training process included supporting the assistants in the training process and ensuring that they had the opportunity to engage with real experience and provide feedback.
6. The final draft of the checklist was prepared following a pilot study. In consequence, the checklist had six items deleted from the student components with one item replaced to suit the needs of the students. The pilot study was therefore valuable in terms of developing an appropriate checklist suitable for the research study.
7. Reliability and validity: There are two aspects to fidelity; first, whether the programme was implemented as required, and second, if the observations made by observers can be considered as reliable (i.e. whether they are consistent). For any piece of research to be reliable, it is important to know the extent to which the results can be repeated when tested. For example, a test can have a high intra-rater reliability but may have a low inter-rater reliability or vice versa. Inter-rater reliability can be particularly low for tests which are

subjective, as those who are engaged in the rating process may have diverse perceptions of what is being looked for. If the two raters have a high level of agreement in their scores (as is the case in this study), the test is seen to be reliable. It is, however, important to note that whilst Reliability shows inter-rater agreement, both observers could be incorrect in their interpretations and miss key observations – in statistical terms, a Type II error. Therefore, in principle it is necessary to have both reliability and validity.

6. Therefore, several observations which were made initially that were similar to the observation that took place during the PALS sessions and involved the use of the PALS checklist of the required PALS components. The two observers recorded whether the teacher and students completed the PALS activity correctly. The observers collected inter-observer agreement several times, and improvement scores over time, to over 90% data accuracy, at which point observation sessions began.

The structured observations were conducted at weeks 4, 6, 7, 8, 9, 10, 11 and 12 to ensure that every student dyad was observed interacting. During the observations, accounts of PALS features which were observed were divided into three components to assess the fidelity of each trainee teacher. The derived percentage of correctly implemented PALS features for each component was obtained separately; the number of features was observed divided by the sum of those not observed and observed. Observers were trained to 94% agreement on inter-observer checks, which were conducted on 50% of the observed PALS sessions giving confidence in the outcome.

3.3.9 Quantitative Analysis

Quantitative data analysis was undertaken in accordance with the four research questions described at the outset of this chapter. As noted previously, they operate at two levels - academic university level and at class level. The treatment of the analysis of each of four research questions was as follows:

- **RQ1:** This comprised descriptive statistics. Each pretesting and post-test were converted into percentages and then the participant percentages were compared pre-and post-test, engaging with the peer tutoring course.
- **RQ2:** This also comprised descriptive statistics of treatment of fidelity the percentage of the agreement between the two observers regarding the PALS

group and derived percentage of correctly implemented PALS features with each component counted separately. As previously, the number of features observed was divided by the sum of features observed and not observed to reach a percentage outcome.

- **RQ3:** utilising the raw scores from the WRAT-4 maths subtest pre-test and post test scores, this involved the analysis of covariant associated with Mixed between- within subjects analysis of variance. The two-way between subjects analysis of variance, i.e. ANCOVA (condition), and one within subjects application of ANCOVA (time: pre- vs. post). The purpose of this is to ascertain the changes in the WRAT-4 maths subtest scores with and without peer tutoring interventions to ascertain the interaction effect whilst statistically controlling the additional covariable, age, which as previously described is known to be a potential influencing variable particularly amongst school age children when taking such tests.
- **RQ4:** Utilising the attitudinal questionnaire pre-test and post-test scores, once again two sets of ANCOVA were undertaken to determine whether the change in attitude learning maths scores over time has altered between the control group and the experimental group, i.e. again also seeking an interaction effect. Once again, this test also controlled covariates of age for the same reasons as above.

Some studies make use of this tool; the acronym stands for ‘Analysis of Covariance’. “Analysis of covariance is an extension of analysis of variance that allows [exploration of] differences between groups while statistically controlling for an additional (continuous) variable" (Pallant, 2007: 290). ANCOVA is appropriate when it is not possible to randomly assign the subjects to the different groups (Pallant, 2007). In this study, it was unavoidable to use existing groups (classes of students), that differ on a number of different attributes. The researcher was interested in Age, and therefore, ANCOVA was employed in an attempt to reduce this difference. ANCOVA is a way of analysing the relationship between the dependent and independent variables, while minimising or mitigating the effect that co-variables may have on the data (Pallant, 2007).

Miller (1997) explains that ANOVA is a superior method of analysing both explained and unexplained variance within the sample, working on the fundamental assumption of a normal distribution curve within the population subset. ANOVA has the capacity,

which other tests do not, of being able to segregate the explained and unexplained variance (Pierce, Block & Aguinis, 2004). Also, importantly, ANOVA equally assumes normal distribution of errors, or more specifically, unexplained variance, which is why it is important to recognise the independent covariate of age. Whilst ANOVA is generally considered by statisticians to be a very useful means of ascertaining explained and unexplained variance in order to provide insight into what is driving changes within a population (Gu, 2013), it is also important to note that ANOVA is highly sensitive to outliers or extremes which have the capacity to significantly distort overall outcomes, leading to the false rejection of the null hypothesis when this should not be an appropriate response (Miller, 1997). This is why Field (2013) argues that it is also important to undertake descriptive statistical analysis first, and also preferably frequency analysis to ascertain the spread of vision of the data and if necessary winsorise extreme outliers in order to avoid this outcome.

3.3.10 Evaluation of the Quality of the Quantitative Data

Carmines and Zeller (1979), Yu (2005) and Kubiszyn and Borich (2015) concur that reliability and validity are perhaps the most important aspects of some types of research methodology. Collectively, they refer to the quality of the data collection and analysis process and subsequent outcomes, with reliability being concerned with the repeatability or consistency of the methodology, i.e. if it were applied in a similar situation would similar results occur therefore supporting the notion of generalisability. Likewise, validity demonstrates the extent to which the research methodology actually measures what it purports to measure and whether it does so consistently. Although these are often treated as synonymous items (Yu, 2005), Kubiszyn and Borich (2015) remind us they are in fact distinct and should be recognised as such with regard to the quantitative and qualitative aspects of the research methodology described in this chapter. Furthermore, it is also important to make reference to the notion of triangulation, that is to say bringing together the outcomes of the discrete research instruments under the mixed methods and its relevant assumptions as discussed previously in this chapter in *Section 3.2.2*.

The reliability of the quantitative methods used for data collection and analysis has been described in the relevant sections regarding the selection and/or development and adaptation of existing research instruments to collect data regarding:

- peer tutoring (PALS)

- mathematics attainment
- attitudinal responses to maths
- treatment fidelity

As described in *Section 3.3.8,* for each aspect of this in multistage process was adopted in accordance with the literature, with relevant scale items utilised, tested and verified utilising feedback and pilot studies in each and every instance. The objectivity, reliability, and validity of each instrument is considered to be acceptable in its own right, and also in accumulation, giving overall confidence to the reliability of the quantitative methods adopted in this study.

3.4 PART TWO: Interpretive Methodology

This section of the chapter focuses upon the qualitative element of the research and the interpretive methodology which of necessity arises from this. This section initially discusses the philosophical assumptions which underpin an interpretive methodology framed within a pragmatic perspective, before discussing the research participants and their selection, the detail of the data collection instrument that of semi-structured interview, and also an explanation of the analysis of the qualitative data arising from the interviews.

3.4.1 Philosophical Assumptions

Maxcy (2003) contends that it is important to distinguish between the philosophical assumptions and practical distinctions which underpin interpretive research design. Although it invariably overlaps with qualitative research methodologies, in being textually based and invariably rely on discourse, interpretive methodologies apply a more precise philosophical framework in which to interpret such textual data. For example, interpretive methodologies argue that rather than seeking to establish a theoretical explanation a priori, it is important that in human setting this explanation emerges from the research principle associated with grounded theory (Badley, 2003). Bevir and Kedar (2008:509) argue that interpretive methodologies placed humans at the centre of the research that is to say the research adopts "*an experience-near orientation that sees human action as both meaningful and historically contingent*".

Alvesson and Kärreman (2000) further contend that there are a number of precise techniques which can be used to interpret textual data from an interpretive perspective in order to understand the truth of reality as it appears the participants concerned. Mindful of Biesta's (2010) explanation that truth within a pragmatic context can and does shift as new information present itself and participants reframe their reality on the basis of their own experience, Denzin, Lincoln and Giardina (2006) recommend that sympathetic techniques are applied in this approach. Within this study therefore, consideration was given to utilising the qualitative data software NViVo.

3.4.2 Thematic Analysis

Onwuegbuzie and Leech (2005) propose that when adopting a thematic approach to data analysis, the first stage is to organise the data systematically in order to begin to establish groupings i.e. themes. It is a practical approach which has a wider theoretical implication insofar as it offers an opportunity to begin to understand the data. Onwuegbuzie and Leech (2005) contend that when reading through the data, it is important to recognise that it has three levels; (i) literal, (ii) interpretive; and (iii) reflexive. In prosaic terms, it is as important to understand what is said at face value as it is to understand what is behind what has been said, i.e. its motivations, and also what has not been said, as silence can be as significant as overt statements. This is particularly so when considering an interpretive methodology that seeks an understanding behind what has been said relative to the context of the participants themselves. Clarke and Braun (2013) offer a somewhat different interpretation of grouping data in this manner, suggesting that the interpretive level is concerned with the researcher 'putting themselves in the participants' shoes', and the reflective layer being concerned with the researchers themselves recognising the influence of their own biases, knowledge and understanding. This study adopts the first perspective, that of Onwuegbuzie and Leech (2005), as it is linked to the quantitative methods explained in Part One, rather than seeking an overtly introspective view.

Having grouped the data, Braun and Clarke (2006: 81) note that categories begin to emerge, although it is important that whilst they are "*internally consistent, they must be externally divergent*". In other words, it is vitally important that there is a systematic logical framework for grouping categories, but that there is sufficient differentiation that they can be considered distinct from one another and therefore providing innovative content which merits further and deeper discussion and analysis. Both Onwuegbuzie and Leech (2005) and Braun and Clarke (2006) agree that if categories overlap in any way then they cannot be considered as sufficiently distinct to merit their own grouping. Creswell and Tashakkori (2007) consider that this is analogous to the process of 'winsorising' in quantitative data when there are obvious anomalies which if included would have the effect of wildly distorting overall quantitative interpretation. Hence, the omission of anomalies, provided it is recognised, is acceptable and where relevant was utilised in this study.

Braun and Clarke (2006) note that the categories, once established, can be either unidirectional or multidirectional, leading to the development of matrices for placing the data to ensure the distinct categories, as emphasised by Onwuegbuzie and Leech (2005), and also allowing for the acknowledgement of outliers in terms of qualitative anomalies which cannot be readily categorised in the sense that they overlap. Flick (2014) argues that this is the most critical process, and also the one which is the most time-consuming but the most valuable. Flick suggests that time spent during this element of the process ensures a smooth subsequent analysis and interpretation of qualitative data in a manner which is both logically robust and which later supports the reliability and validity of the qualitative outcomes, one of the areas of qualitative research which is most often attacked in terms of methodological robustness. Once this categorisation has taken place, Flick (2014) suggests that it is then a relatively straightforward matter to decode the data in preparation for subsequent analysis whether this is undertaken using manual techniques or the support of software, such as NVivo.

Within this study, the categorisation of data took place using a themes-situated theory approach. Subsequent analysis through the use of Nvivo aiming for providing "an organised single location storage system" for all stored data to facilitate quick and easy access to the codes (Robson,2011, p.472), and seeking frequencies and therefore provided the opportunity to offer an objective interpretation of the data in a robust and reliable manner. The coding process, according to Clarke and Braun (2013) is also an opportunity to robustly challenge the data itself, something which it is advisable for researchers to undertake in order to ensure that at a subsequent stage they will be in a position to defend their data collection and analysis process. Clarke and Braun (2013: 121) actively recommend that the researchers challenge emergent themes to ascertain whether they will withstand novel interpretation, "*seeking out negative instances that directly undermine this understanding*". The purpose of this process is to ensure that novel insights have categorically been obtained and therefore truth can be understood to be evident in the pragmatic approach of interpretive methodologies.

3.4.3 Participants

The participant population for the semi-structured interviews comprised five trainee teachers who formed the Maths PALS group. The participant population can be said to have been identified in full by default, insofar as whilst the trainee teacher grouping

originally comprised 10 trainee teachers, over the course of the research (due to reasons unconnected with the study) various trainee teachers left the group, leaving only five left in the interviews which were conducted after the quantitative testing approach. Methodologically, a research population of five with regard to qualitative data in a mixed methods study can be considered entirely acceptable (Lincoln & Guba,1985). Therefore, this aspect of the participant process can be considered to be in accordance with recommended methodological guidelines.

3.4.4 Data Collection Instrument

3.4.4.1 *Semi-Structured Interview*

The data collection instrument was that of semi-structured interviews, and there were a number of reasons that this approach was adopted in preference to other types of interview such as fully structured, or open ended. Fully structured interviews, which term suggests provide a number of qualitatively derived but narrow questions that are suitable for harvesting the necessary depth and richness of data required to understand the epistemological perspectives of the research participants (Bryman & Bell, 2015). Adopting the fully structured approach would have negated the capacity to respond properly to research question five which seeks to understand the perceptions of trainee teachers with regard to Maths PALS. Fully structured questions do not facilitate a range of alternative opinions, nor do they take account of different participants' viewpoints particularly easily (Rowley, 2012). Knox and Burkard (2009) contend that certain research studies can and do embrace a fully structured interview approach when there are wider reasons for so doing, but it is not ideal in circumstances where participants are more than capable of providing their own informed view.

The antithesis of fully structured interviews are narrative interviews, also referred to as free-form interviews whereby the interviewer (i.e. the researcher) allows the research interview to flow as it will offer very little intervention because the purpose of such interviews is to allow the research participants to present their narratives uninterrupted (Bryman & Bell, 2015). Again, in certain specific circumstances which are aligned with research aims and objectives, this technique is eminently valid, but it is resource intensive, and regarded by some as high risk (Kavanaugh & Ayres, 1998). The reason for this is it requires a strong and experienced researcher to guide the research interview even when it is free-form in nature, particularly if research

participants are what might be considered as elite interviewees accustomed to achieving their own ends in such circumstances.

Semi-structured interviews in the opinion of Rowley (2012) and also Bryman and Bell (2015) strike an appropriate balance between the two in that they are partially structured having set a number of questions derived from literature or pre-existing research instrument which are open-ended flexible nature to accommodate the different perspectives of research participants their views and opinions. Part of the benefit of semi-structured interviews is that when participants offer unique insight this is not curtailed as it would be in a fully structured interview thus allowing novel information to present itself (Robson, 2011). Pragmatically, semi-structured interviews also make the process of thematic grouping and data coding more straightforward (Krippendorff, 2012), and provided that this is coupled with a robust logical coding approach, such as that described above, then a semi-structured approach can be considered as the most effective for obtaining the necessary data. Semi-structured interviews also - most importantly of all - allow individual participants to reconstruct their own experiences but in a way which facilitates like-for-like comparison and also the presentation of by divergent opinions.

The interview schedule (***Appendix 11***) was developed through a critical consideration of the literature and the adaptation of an existing interview schedule developed by Baker, Gersten, Dimino and Griffiths (2004) whereby certain items were deleted because of their lack of relevance to the study and, one question about strengths was replaced with two additional questions and question about weaknesses further subdivided into three additional questions. The interview schedule was itself first written in English in accordance with the original research paper from which it was developed, and then translated into Arabic for participant administration, before the responses from the transcripts were then translated back into English. This was undertaken by the researcher given her fluency in both languages and was revised by an interpreter, and also the predominantly inductive approach of the data reading as described above. The researcher undertaking the translations can also help to ensure that none of the inherent meaning from the interviews and their transcripts was lost, something which is described above with regards to the layers of interpretive reading is important.

The semi-structured interviews conducted at the conclusion of the course with the five trainee teachers who taught the intervention group. The average interview lasted

about thirty-five (35) minutes and was carried out at the same case schools. The interviews were recorded using a digital voice recorder, then, after each interview, the recording verbatim were transcribed and the whole transcription were checked in details with the interviewee. The transcripts were translated from Arabic into English and the interpreter considered to give the best English word for the Arabic word. The translated transcripts then were revised to ensure that nothing was misinterpreted.

3.4.4.2 *Pilot Study of the Semi-Structured Interviews*

The interview was piloted before its actual use with two colleagues who took part in the training workshop of the Maths PALS which was delivered by a US academic member of the PALS training organisation (Dr Sarah Powell). The purpose of this was to obtain feedback and ensure clarity and relevance of the interview items. The pilot was to help gauge approximately how long the interview would take to be able to articulate this in a fair and consistent manner to the participants before they engaged in the interview. Also the interviewees were asked to comment on the researcher's performance which was therefore valuable in terms of developing interview skills. The revised version of the research instrument following the pilot feedback was sent to the supervisors of the researcher to obtain their comments and ensure that the formulation of the research items was appropriate to the respondents and also that they were clear, easy to understand, and allow the participants to readily and easily express their opinions. This is also important when translating between languages and cultures which do not necessarily have direct comparators, and thus although the pilot testing was a lengthy and resource intensive process, it was considered to be particularly important, an opinion also shared by Neuendorf (2016).

3.4.5 Qualitative Data Analysis

Research question 5 is more interpretive based on difference and commonality of perceptions and the data is probably qualitative in nature looking at the experiences of staff and students to better understand the specific experience of trying such an approach. The thematic analysis adopted in this study started with predetermined themes that arose from the research questions and the reading of the literature. Robson (2011) highlights the view that "such preconceptions" could bias the researcher to look only for specific aspects of the data and therefore might overlook

other potential themes that are relevant to the study. Another view is supportive of prior engagement with the literature since this could sensitize the researcher to possible themes that might otherwise be ignored (Robson, 2011). In this study, thematic analysis was also adopted inductively, i.e. the researcher was able to identify themes that were not predetermined but emerged from the researcher's engagement with the data.

In this regard, the researcher read the transcripts several times which helped stimulate questions after each reading, to clarify meaning and to gain a profound comprehension of the following reading. The coding of the data was revised several times and specific quotations were used as evidence. The data was manually coded in the first instance and then was input and organised into NVivo.

The trustworthiness of interviews was taken into consideration through corroboration of data in terms of relevance and later through returning the transcribed recording to participants for their confirmation. However, there are certain limitations of interviews, such as possible unintentional bias in data collection and interpretation. Several possible biases can result from the research operation for both the researcher and the interviewer, such as selectivity by the researcher may introduce bias, as may attention to detail and interpretation of the data. To address this issue, in conformity with the study's interpretivist philosophical assumptions, the researcher made efforts to put aside her own individual views and refrain from influencing the data and the findings as will be discussed in some detail in a later section 3.4.6.

Advantages and Disadvantages of Nvivo: Leech and Onwuegbuzie (2011) note that NVivo has gained increasing popularity amongst social sciences researchers for practical reason, which can be categorised into ease of data analysis, and also subsequent support in defence of their research, as it is possible to demonstrate scientific rigour and objectivity more easily where NVivo has been used. In somewhat prosaic terms, it is harder to argue with the output of automatically calculated frequencies presented by the software in a variety of images. NVivo also offers the opportunity to undertake matrix-style analysis of qualitative data, something which is often very challenging in manual practice, recognising the recommendations of Onwuegbuzie and Leech (2005) and also Braun and Clarke (2006) about the use of multidimensional categorisation. This is an opportunity to elicit novel insights recognising the interrelationship of categories but without reaching a situation where they overlap and therefore lack sufficient distinction.

NVivo is not entirely without disadvantage, however, as it is still common practice amongst methodological experts to recommend a subsequent manual check of the analysis output presented by the software (Gibbs, 2011). In part, this is to ensure that the coding was correct in the first instance, i.e. the findings are broadly in accordance with what was anticipated, and also as a further layer of sense-making the definition of reflective layers as presented by Clarke and Braun (2013). NVivo also requires relatively extensive training to become familiar with its application and in some senses (Welsh. 2002). In light of these advantages and disadvantages, Brandão and Miguez (2016) argue that the utilisation of NVivo can still be considered as relatively novel, in that it is not as widely used as its contemporary SPSS, but it is a software application which is gaining traction and in the assistance have provided additional depth and breadth to the qualitative data analysis and interpretation.

3.4.6 Evaluation of the Quality of the Qualitative data

Similarly, to assessing the quality and reliability of quantitative data, the reliability of qualitative methods also involves a multistage process as recommended by Haertel (2013), to ensure the trustworthiness of the qualitative research outcomes. Principally, recognition of the coding process using a qualitative research instrument drawn from existing literature with appropriate items adapted to suit the specific needs of the research and therefore achieved research aim and objectives. The detail of the data collection process and subsequent coding before analysis utilising appropriate software (NVivo), plus the subsequent interpretation of the data arising from this also gives confidence to the reliability of the qualitative method utilised the data collection in this study. According to Gibbs (2011) and also Haerel (2013), this multistage process of data collection and analysis grounded in current methods can be said to demonstrate the trustworthiness and dependability of the qualitative data.

Hoepfl (1997) has examined the issue of demonstrating the quality of qualitative data in greater depth, drawing on the work of Lincoln and Guba (1985), who themselves draw parallels between conventional terms for assessing data quality

under a quantitative paradigm, and naturalistic terms under a qualitative paradigm. These are presented below in ***Table 3.5***, and discussed in turn in relation to the data gathered and analysed in this study.

Conventional terms	Naturalistic terms
internal validity	credibility
external validity	transferability
reliability	dependability
objectivity	confirmability

Table 3.5:Comparison of criteria for judging the quality of quantitative versus qualitative research (Lincoln & Guba, 1985, p.300)

Credibility: Credibility refers to the extent to which the data can be said to accurately reflect reality while being mindful of the fundamental issue that reality in epistemological terms differs from one individual to the next. In a qualitative setting, therefore, it is necessary to demonstrate the accuracy and existence of multiple realities even if they are only very subtly differentiated. In the opinion of Hoepfl (1997, p.51), "*credibility is the test for this*". Hoepfl's (1997) view is shared by that of Patton (1990), who indicates that there are four alternative tests of credibility in a qualitative setting, relative to the nature and volume of the data, and also its richness in gathering the necessary depth and breadth of perspectives and/or realities. In this study, this was undertaken by means of data triangulation comparing and contrasting the qualitative data outputs.

Transferability: Is the appealing scientific notion of being able to apply conclusions from one study to a similar set of circumstances with the expectation of a similar result. Occasionally referred to as naturalistic generalisability, it is actively sought in quantitative settings as demonstrable evidence of the rigour of a scientific study, although supporters of a qualitative interpretation emphasise that this is likely to be less useful in a qualitative setting, principally because it is important to recognise the individualistic nature of each and every qualitative investigation. Scholars such as Patton (1990) and also Cronbach (1975) are keen to highlight that the best that can be hoped for in terms of transferability in a qualitative study is some measure of likely anticipation of outcome in a similar set of circumstances. In this instance, the findings have relative transferability unique to the settings of the case study organisation, and to a lesser extent the cultural setting in which the research took place, but it is acknowledged that there is less likely to be transferability in relation to wider international application.

Dependability: In quantitative terms, reliability – the equivalent of dependability – is said to occur when repeated applications of tests produce consistent, reliable, results. This gives confidence in the usefulness of the test. In qualitative terms, there

is much less methodological guidance on the equivalent point of how any test or method can be considered to be consistently dependable in terms of delivering relevant and reliable outcomes. Guidance on this point is once again obtained from Lincoln and Guba (1985, p.317), who propose an "*inquiry audit*", which is an external objective assessment of both the methodology of the research and the output. In this study, the detail presented in this chapter is considered to provide sufficient evidence of this.

Confirmability: Recognised as objectivity in predominantly quantitative studies, confidence that the research process and outcomes are value-free is widely lauded as one of the principal benefits of quantitative investigation, whereas qualitative collection and interpretation, which by its nature is value-bound, is often subjected to considerable criticism on this basis. Some scholars, such as Kirk and Miller (1986), consider that overt focus on the relative objectivity versus subjectivity of data collection and interpretation is misguided in that it diverts attention from the overall quality of research irrespective of the preferred data mode. Indeed, there is some criticism of the true objectivity of quantitative investigation itself, given that at some point a decision must have been made as regards what type of data is collected, and what tests to apply, and even whether data has been selectively winsorised in order to conform to expectations of reality. This is why Patton (1990, p.55) recommends "*empathetic neutrality*", which he describes as being the process of being empathetic to the multiple realities of the participants involved during qualitative data collection, but equally neutral as to the implications of the findings once they have been analysed. This is the stance which has been adopted in this investigation.

It is worthwhile briefly noting that Smith and Heshusius (1986) strongly criticised Lincoln and Guba's (1985) suggestions, arguing that the epistemological interpretations framed under a qualitative perspective are in reality little different than the existing conventional and would typically quantitative terms. Smith and Heshusius (1986) further contend that as qualitative research can only ever constitute an interpretation of an interpretation, insofar as qualitative analysis represents the researcher's interpretation of participant responses, with no absolute understanding of participant perspective, then attempts to further categorise the scientific rigour necessary to demonstrate quality in data collection and analysis is largely meaningless. However, Hoepfl (1997) counteracts that semantics aside, the issue of ascertaining the quality and scientific rigour of data collection and analysis

irrespective of its format remains imperative, hence the need to demonstrate the four aspects of data quality as described above. In brief, while there exist abstract points about interpretations of data, it is nevertheless possible to follow methodologies which aid the credibility, transferability, dependability, and confirmability of data.

3.5 Validity and Validation of Research (Triangulation)

Mertens (2014) contends that while there is debate and discussion surrounding the philosophical position of mixed methods research, there is also debate and discussion surrounding the final stage in the process when seeking to synthesise or triangulate mixed data formats. Cohen et al. (2013) argue that the increasing sophistication of software and technology is a great help to researchers in this matter as it now becomes much easier to bring together multiple forms of data in a systematic manner thereby adding to the richness of data so valuable in mixed methods research. Validation in triangulation remains area of contention amongst academics as some argue that the dual combination of conversion process seeking to transform qualitative into quantity of output comparison will be subject to bias and risk. Attempts to generalise this process in order to avoid this issue have met with competing outcomes, not least of which because in the view of Ruben and Babbie (2016), one of the fundamental issues in social sciences is that it is impossible to precisely measure the same thing twice. The reason for this is that humans by their very nature evolve, both in response to themselves (i.e. personal learning), and also wider circumstances. The irony of this is that this evolution is precisely what this study sought to measure, but the difficulty is that it poses inherent threat to the validity of triangulation when seeking to synthesise the disparate forms of data. Likewise, Mertens (2014: 186) argues that adopting a "*toolkit*" approach to synthesising mixed methods of data in social sciences sidesteps the very depths of data which the researcher seeking to ascertain thereby negating the value arising from utilisation of mixed methods.

Fielding (2012) makes extensive references to longitudinal study undertaken with regards to attitudes in a legal environment comparing alternative methods of reaching the same outcomes. Matching statistical evidence to discursive data Adler (2003, cited in Fielding, 2012) was able to demonstrate systematic triangulation also highlighting the value of mixed methods data. Taking the statistical data to the research participants demonstrating quantitative evidence of change and asking the distance their opinion of why they felt this change may have occurred provided therefore necessary validity and validation of the mixed methods approach reaching the zenith of mixed methods outcomes, a proven quantitative and reliable finding with the variance explained by means of qualitative outcomes. This same process is therefore adopted in this study highlighting the critical importance of systematic

approaches to triangulation in order to overcome the risks and limitations associated not only with mixed methods research, subsequent synthesis in a novel environment.

3.6 Ethical Considerations

3.6.1 Participants Awareness and Permissions

Ethical participation within any research study is always an important issue for researchers to consider especially where there is any possibility of the research participants being considered in any way vulnerable (Best & Khan, 2014). Children with MLD / SEN are likely to fall into this category as they are unable to give explicit informed consent and therefore a number of safeguards are put in place when collecting data from participants and ensuring that best practice in every aspect is adhered to. Accordingly, the following ethical measures were undertaken.

Approval from the Ministry of Higher Education and King Saud university in Saudi Arabia, ethical approval from Exeter University, all of the consent forms were provided in Arabic, copies of which are presented in ***Appendix 12***, with informed consent given by the trainee teachers, the visiting tutors, and research assistants as well as informed consent from the school principal in each of the two schools undertaken in the study. The school principal provided assent for each school to participate in the research on behalf of the school more widely. On the part of the pupils, they were also asked by assent form, which detailed what would be required of them, if they wished to participate in the study before it took place, and passive consent was provided by their parents with general information about the research project being provided.

At no stage was any research participant forced or influenced to engage the research project meaning that participation in the class is entirely voluntary and the participants also had at any stage the opportunity to withdraw from the study without needing to give any reason or explanation. Likewise, the parents of the half of the SEN children could choose to withdraw the children from the study at any time without the need to explain, and to maintain normality during the data collection analysis process no additional changes were made for pupils within the SEN classes than would otherwise be the case. No exceptional factors emerged which may raise ethical issues in the sense that it is a pedagogical experimental study and not one done in the critical research tradition. In plain terms, no interventions were deliberately designed to provoke a response. The information provided to all

participants explained that the purpose of the study is to assist the researcher with their Ph.D. research and the aim and objectives, as well as the funding of the study, were explained. All of these aspects are in accordance with recognised good practice in respect of research ethics in a participant based study such as this, and also the guidelines provided by the University with the consent of the tutors and satisfaction of the ethics committee.

3.6.2 Considerations during Data Collection

For completeness, it is also noted that good practice followed in respect of data collection confidentiality and anonymity with complete traceability and security of the primary data in all its various forms that were collected. All of the responses were confidential, as participants were assured of before completion, with individuals only identifiable to the main researcher via an alphanumeric code. Once the data has been collected analysed and the study has been marked, the primary data will be destroyed. In the meantime, is maintained securely in either a password protected data file, or a secure location to which only the researcher has access.

The quantitative data gathered by the various research instruments was always handled in secure envelopes with a chain of handover with each individual responsible for testing all post testing for observation signing receipt of the documents. The same procedure was followed in respect of the observation checklist.

The qualitative data gathered from the semi-structured interviews was recorded with the consent of the participants, although they were all free to refuse to have their interviews recorded. Once they were recorded the transcripts were digitally transcribed for substance analysis following the procedure described above in *Section 3.4.3.1*. Again, once the main study has been marked and an award achieved, this data will be destroyed.

3.7 Summary

This chapter has provided a detailed explanation of each stage of the research process following guidance from experts in the field of research methodology prevailing good practice specific to the field of research in education and also general guidance in regards to the collection and systematic analysis of data in accordance with mixed methods principles. The purpose of providing such a detailed explanation is to demonstrate in part the reliability and validity of this research seeking to provide

novel insight into an area of special needs education, and by providing a highly detailed explanation it is therefore possible for external parties to follow the process of themselves and ascertain validity, reliability and appropriate generalisability which is the overarching aim of the main research questions seeking to ascertain the impact or otherwise of introducing Maths PALS to special educational needs pupils within primary schools in Saudi Arabia, and potentially also the wider educational curriculum. As described in this chapter, the process of achieving this was to utilise a quasi-experimental approach utilising pre-testing and post-testing on four dimensions regarding mathematical attainment, attitudes towards the mathematics, gain in knowledge of peer tutoring, and fidelity of the Maths PALS process. This was supplemented with discussions with the trainee teachers in question to understand their unique perspectives of the process of peer tutoring, something which is not widely used within Saudi Arabia in order to explain the various is identified from the quantitative data which are discussed in depth in the following chapters. Throughout the entirety of the process, good practice in research ethics was adopted, alongside good practice in methodological applications, and the respective advantages and disadvantages associated with this methodology have been described discussed and justified. Thus, the detail of this chapter provides a foundation for the analysis and interpretation stages which are presented in the chapters which follow.

4 Chapter Four: Findings

4.1 Introduction

This chapter provides a record of the results of the investigations into peer tutoring in two sections, the first covering the process and outcomes element of the study whilst the second covers the interpretive element. The process and outcomes element involves data that investigated the gains in knowledge for practitioners involved who undertook a preparatory course in peer tutoring, the fidelity of implementing a peer tutoring programme, the effect of peer tutoring on pupil performance in mathematics and the effect of peer tutoring on pupil attitudes towards mathematics. The interpretive section of the results provides a record of the data from a series of semi-structured interviews which are organised by theme.

4.2 Section One: Process and outcomes of peer tutoring programme (Maths PALS)

It is important to note that all of the participant trainee teachers (five in experimental groups, five in control groups) had been introduced to a number of different training methods as a part of their course at university, but crucially, these training methods did not include peer tutoring. Only the five randomly selected trainee teachers were provided with the opportunity to train in the use and implementation of Maths PALS, which safeguards the integrity and veracity of the study because the control group trainee practitioners had no knowledge of peer tutoring at the time of the study. Those who had been in receipt of training delivered the Maths PALS programme to 5 classes of SEN students (26 in total) in two state schools in Riyadh to girls between the ages of 7 and 15. These individuals had previously been identified as having mild intellectual disabilities. The control group students (27 SEN students) were taught using conventional methods in two state schools over a three-month period, making a total of 10 classes of female students across the two schools.

The findings for the process and outcomes section of the research will be set out and analysed, separated by research question as following:

4.2.1 Result of Peer Tutoring test to Evaluate Gains in Knowledge about Peer Tutoring for the Trainee Teachers of SEN Children who have undertaken a Preparatory Peer Tutoring Course

This section presents the results of knowledge test which was found to be reliable as shown in methods chapter section 3.3.8.1. ***Table 4.1*** illustrates the percentage scores on the test which assessed the PALS group of trainee teachers' knowledge of peer tutoring. The aim of this test was to gain an accurate picture of the participants' knowledge of peer tutoring prior to engaging with the Maths PALS course, and their knowledge of peer tutoring after their training course and having delivered it over a period of two weeks.

Trainee Teachers	knowledge of PT prior to being trained in the delivery of PT	knowledge of PT after two weeks of delivery of PT
No. 1 (Abeer)	38.78 %	87.76 %
No. 2 (Afnan)	46.49 %	73.47 %
No. 3 (Amal)	40.82 %	83.67 %
No. 4 Noura)	46.94 %	77.55 %
No. 5 (Nada)	55.10 %	81.63 %

Table 4.1:Trainee teachers' percentage scores of peer tutoring Knowledge

These figures indicate that increases in knowledge range from 26.53% (Trainee Teacher No. 5) to 48.98% (Trainee Teacher No.1). Each of the participants gained in knowledge of peer tutoring as a result of being exposed to the training programme and delivering Maths PALS.

4.2.2 Result of the Evaluation of Fidelity of Implementing Peer Tutoring Programme (Maths PALS) According to Expected Guidelines

The rationale for evaluating the fidelity of implementing the peer tutoring programme lies in the need to assess whether the programme was implemented as required. The reliability and validity of data obtained from the structured observational schedule were established between the observers at training stage before observation sessions began, in which observer consistency was developed, and

scores of inter-observer agreement were improved over time. The Observers were trained to over 90% agreement as discussed in methods chapter section 3.3.8.4.

Two visiting tutors and two research assistants were involved in the programme, to the extent that they had completed a Maths PALS workshop and were trained in PALS observation; a checklist to be utilised during observation was given before the implementation of the programme. Each trainee of the PALS group was observed on eight occasions, with four observations being conducted by two observers simultaneously to calculate the inter- observer agreement. During the PALS session, the two observers had to observe each PALS trainee teacher and at the same time they had to observe how each pair of students interacted with each other (Fuchs et al, 2002). The first observation was conducted during week 6 of the 12-week implementation; the second during week 8, the third during week 10, and the forth during week 12. Throughout these observations, the observers placed a checkmark for each PALS feature has been identified. The checklist divided PALS features into PALS procedures given by the teacher components (e.g. teacher reviews PALS rules with class), assistance given by the teacher to pair group components (e.g. teacher provides feedback) and students' implementing of PALS procedures components (e.g. tutor use correction procedure when applicable). The checklist also described the fidelity of implementing PALS features for each trainee teacher and her students. It is worth mentioning that the teacher was the focus of analysis, not the student (Fuchs et al, 2002). To derive a measure of the correct implementation of Maths PALS, the number of features observed was divided by the sum of those observed and not observed (Fuchs et al, 2002).

	Co-Observer Sessions				
	1	2	3	4	Average
PALS Group	94.2 %	95.1 %	96.9 %	99 %	96.3 %

Table 4.2: Inter- observer agreement of treatment as percentages of observations

Table 4.2 displays the inter-observe agreement, which is the percentage of agreement between the two observers (the first observer is the research assistant and the second is the visiting tutor) regarding the PALS group. Inter-observer checks, conducted on 50% of the observed PALS sessions showed agreements between 94.2% to 99%, with an average of 96%.

In order to establish the fidelity (the number of techniques the practitioners applied and the expected behaviours that the students showed), data was generated by the observers completing the Maths PALS checklist, using ticks when techniques or behaviours were observed on eight occasions. The average figures of fidelity of implementing PALS features across all trainee teachers and their students are presented as percentages of observations below (refer to ***Appendix 13*** for details).

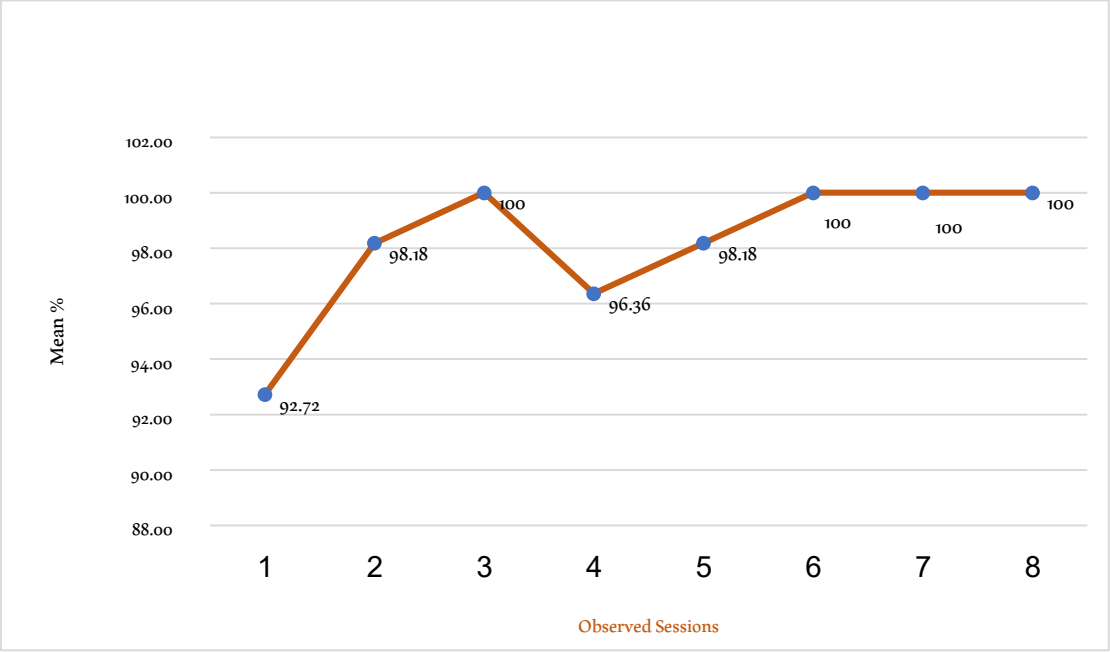

Figure 4.1: Line chart showing fidelity of implementing PALS procedures given by the teachers as percentages of observations

The above line chart illustrates a fluctuating trend in the implementation of PALS procedures given by the 5 trainee teachers in the first five sessions. In the final three sessions, 100% implementation is observed across all teachers.

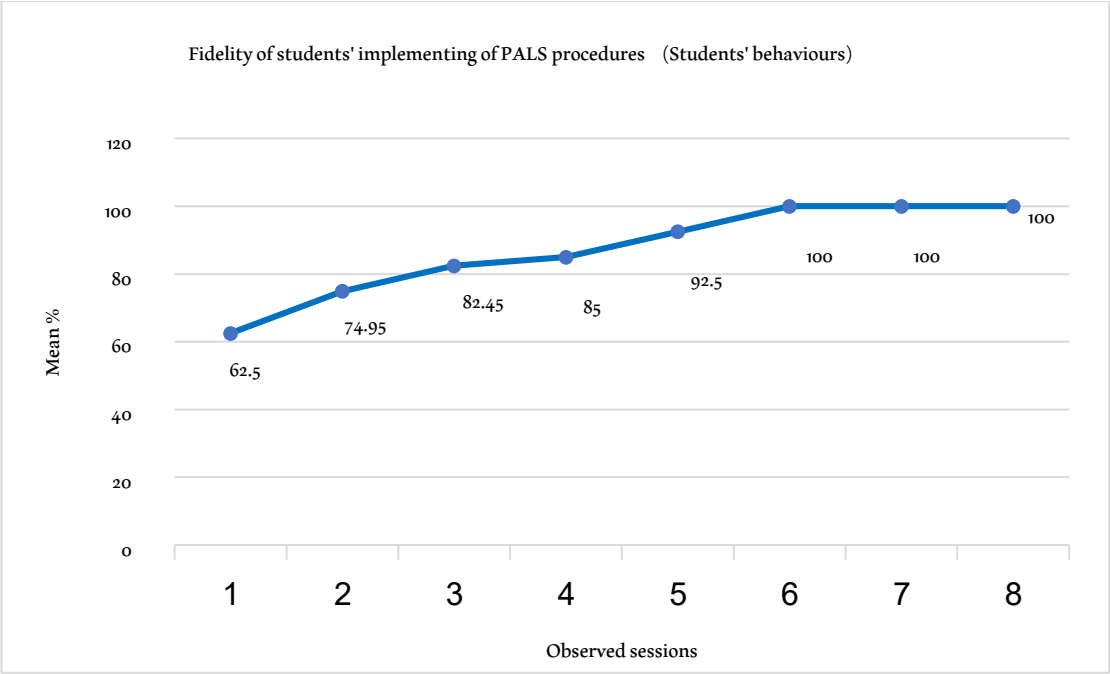

Figure 4.2: Line chart showing fidelity of students' implementing PALS procedures as percentages of observations

Figure 4.2 demonstrates an improvement in the students' learning to use the PALS procedures across all classes. The students' ability to follow these procedures was demonstrated in an increase in fidelity from 62.5% to 100%. The improvement in PALS behaviour implemented through paired work rose steadily over the first six sessions, reaching 100% fidelity in the final three sessions.

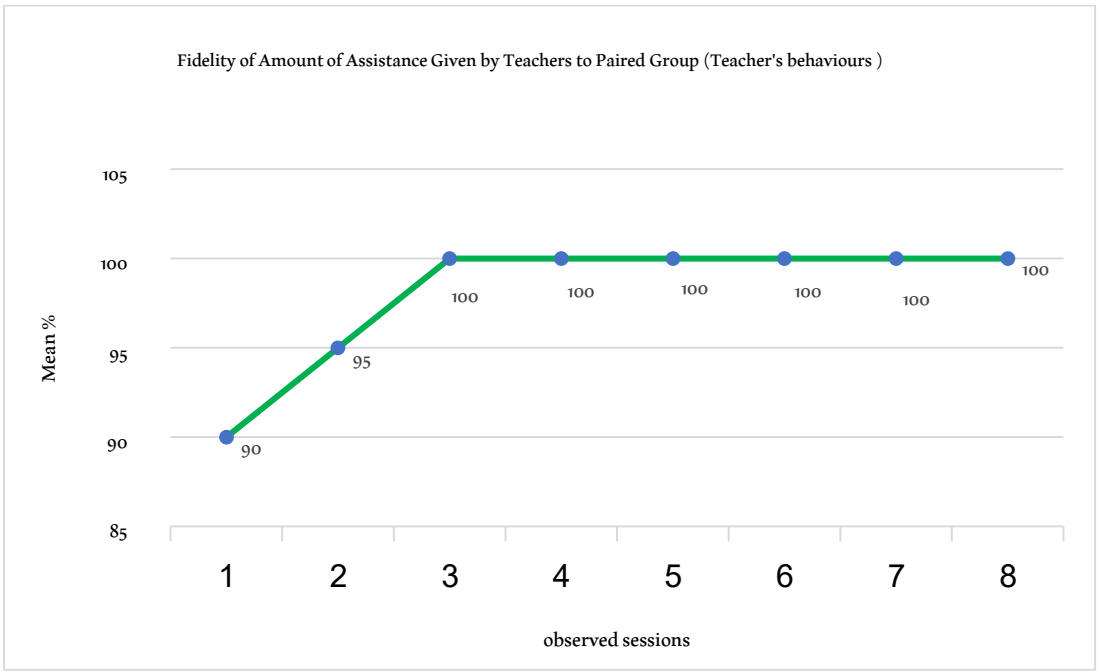

Figure 4.3: Line chart showing fidelity of amount of assistance given by 5 teachers to paired groups as percentages of observations

Figure 4.3 shows an increase in the amount of assistance given by the 5 trainee teacher to the paired groups over the initial two sessions; the maximum level of assistance is reached during the following six sessions.

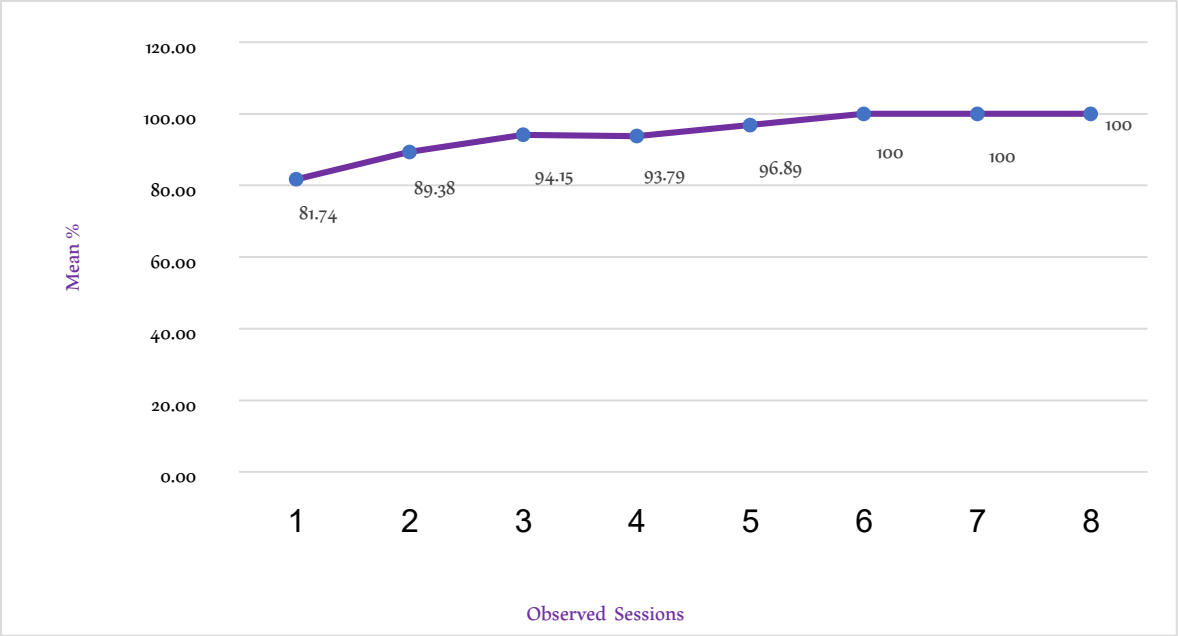

Figure 4.4: Line chart showing fidelity of overall implementation of all aspects of PALS as percentages of observations

Figure 4.4 shows a steady upward trend with regard to the overall implementation of all aspects of the PALS programme, from both the teacher's and the student's perspective.

4.2.3 Result of Evaluation of the Effect of Peer Tutoring Programme (Maths PALS) in Improvements in Mathematics for Pupils with Intellectual Disabilities

RQ3 was addressed by comparing the total raw scores of pre-test and post-test WRAT-4 Maths subtest between the intervention group (PALS group) and the control group (no-PALS group). The students in each group were all tested prior to the beginning of the three-month teaching period by the trainee teachers in order to assess their mathematics attainment, and were tested again at the end of the three months by the research assistants.

Analysis of covariance were conducted associated with two-way between-subjects analysis of variance (ANCOVA: condition), one within-subjects (Time: pre vs. post) ANCOVA (see methods chapter section 3.3.9). It illustrated whether the change in the WRAT-4 Maths subtest scores over time is different for the two groups (an

interaction effect) while statistically controlling for an additional variable (Age) that is expected to influence scores on the independent variable.

In other words, the researcher conducted a mixed between-subjects (treatment: PALS vs no-PALS) and within-subjects (measure: pre- intervention raw score vs post-intervention raw score). ANCOVA was used to control whether the age of the students had any influence upon the effectiveness of the PALS programme for student outcomes. The variable in this instance was time; Time 1 refers to the pre-intervention raw score in the WRAT-4 Maths subtest, with Time 2 therefore being the post-intervention raw score in the WRAT-4 Maths subtest.

Maths Scores	Group	Mean	Std. Deviation	n
Pre- intervention Raw scores	Control Group	7.33	6.805	27
	Intervention Group	11.19	4.167	26
Post-intervention Raw scores	Control Group	11.85	6.175	27
	Intervention Group	17.81	2.417	26

Table 4.3: Descriptive statistics of mathematics scores for intervention and control group from before to after the intervention

Table 4.3 provides full details regarding pre-intervention and post-intervention mathematics scores for each of the groups for their WRAT-4 Maths subtests. The assumption of normality was met for the ANCOVA to proceed (refer to ***Appendix 14*** for details). The results of the ANCOVA analysis (refer to ***Appendix 14*** for tables) indicated that the main effect of Time was significant, Wilks' Lambda =.77, F (1,50) = 14.74, p < .001, η^2_p = .23. There was no significant interaction between Time and Age, Wilks' Lambda =1.00, F (1,50) =.008, p = .928, η^2_p = .000. There was a significant interaction between Time and Group, Wilks' Lambda =.81, F (1,50) = 11.3, p < .001, η^2_p =.184. The partial eta squared value obtained for Time suggests a large effect size of this result according to "the guidelines proposed by Cohen (1988, pp.284-7)" (Pallant, 2007, p.208).

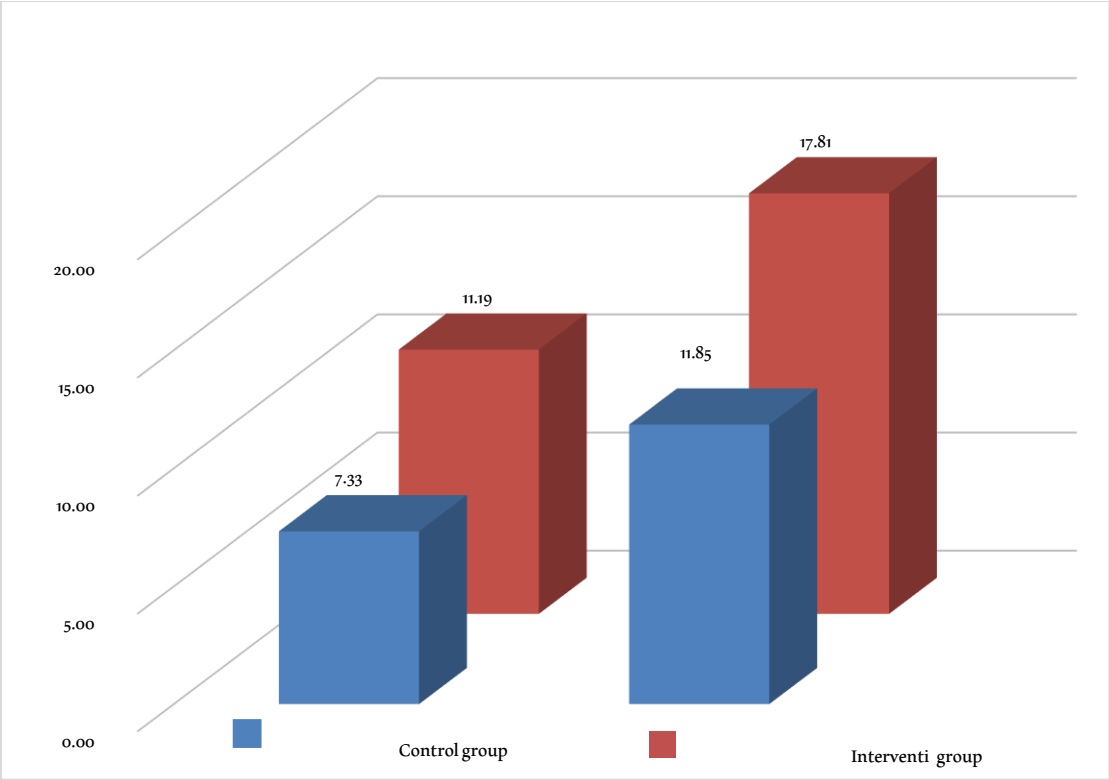

Figure 4.5:Bar chart showing mean mathematics scores for pre-and post-intervention

The above bar chart provides an overview of the situation both before and after the implementation of the PALS programme. It is important to note that the control group and the intervention group are at different levels (control group 7.33, intervention group 11.19) at the start of the period of the Maths PALS programme.

It shows that both groups made progress during the course of the three-month period. The control group's post- intervention scores rose to 11.85, an increase of 4.52, while the intervention group's scores rose to 17.81, an increase of 6.62. These results indicate that the intervention group has made more progress over the period of the implementation of the programme.

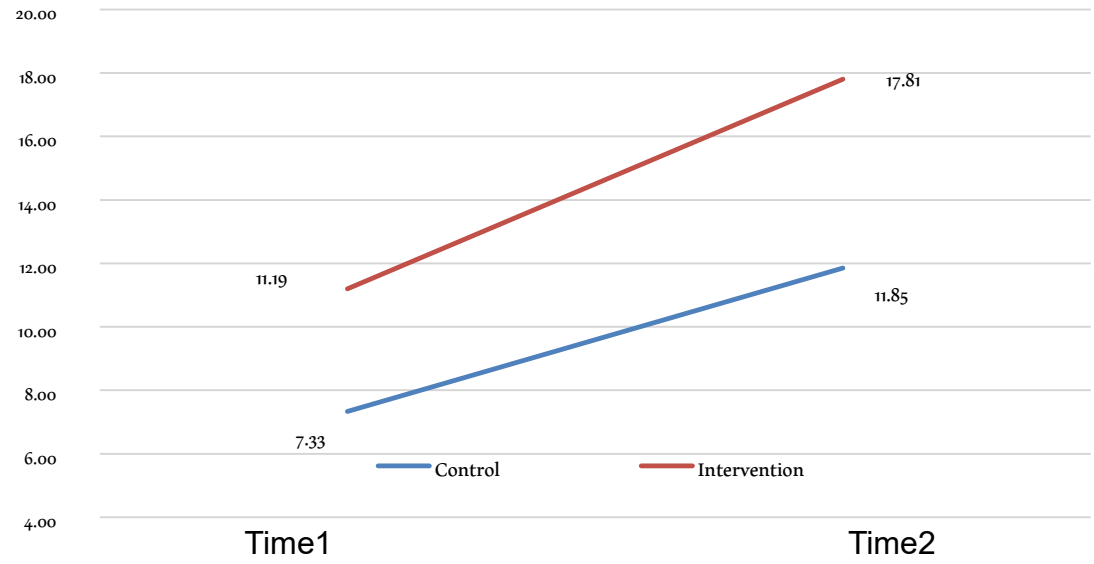

Figure 4.6:: Line chart showing comparison of maths scores for intervention and control groups before to after the intervention

The aim of the research was to investigate the effect of the Maths PALS programme on students' attainment in mathematics by comparing the pre-raw and post-raw scores. However, the researcher also wanted to explore whether the effect is different between experimental group and control group. ***Figure 4.6*** illustrates the contrast between the two groups' pre and post-intervention scores: one argument which could be made is the fact that the differences that are apparent in the pre-intervention scores between the two groups is related to the difference in their age. This factor seemed important to note, as the participants' ages range from 7 to 15. In light of this, the researcher utilised ANCOVA to take account of the differences in age. The additional variable (Age) called (a covariate) is variable that might influence scores on the dependent variable (Pallant, 2007). SPSS uses regression procedure to remove the variance in the dependent variable that is due to the covariate and performs the normal analysis of variance techniques on the corrected or adjusted scores, by removing the influence of this additional variable (Pallant, 2007). Mixed between-within subjects ANCOVA was able to detect differences between the two groups.

Its aim was to indicate whether there is a significant main effect for the independent variable (Group or Age) and whether the interaction between these two variables is statistically significant (Pallant, 2007). First the Levene's Test of Equality of Error Variances box was checked and in this case, the value for each variable (pre-test

score/ post-test score) was greater than 0.05; therefore, it was safe to proceed. The next box to check was Box's Test of Equality of Covariance Matrices. A significant value that is bigger than .001 was needed. In this case, $p < .001$; therefore, this assumption has been violated and the value that has been selected is Wilks' Lambda. (Pallant, 2007). Of most interest is the interaction, so the Multivariate test box was used **(**refer to **Appendix 14** for tables) for identifying the main effect of Time and its interactions with Age and Group. These results are presented previously at the bottom of p.123**.**

The evidence suggests that when Age is controlled, there is a statistically significant interaction effect between Group type and Time, producing the following line chart:

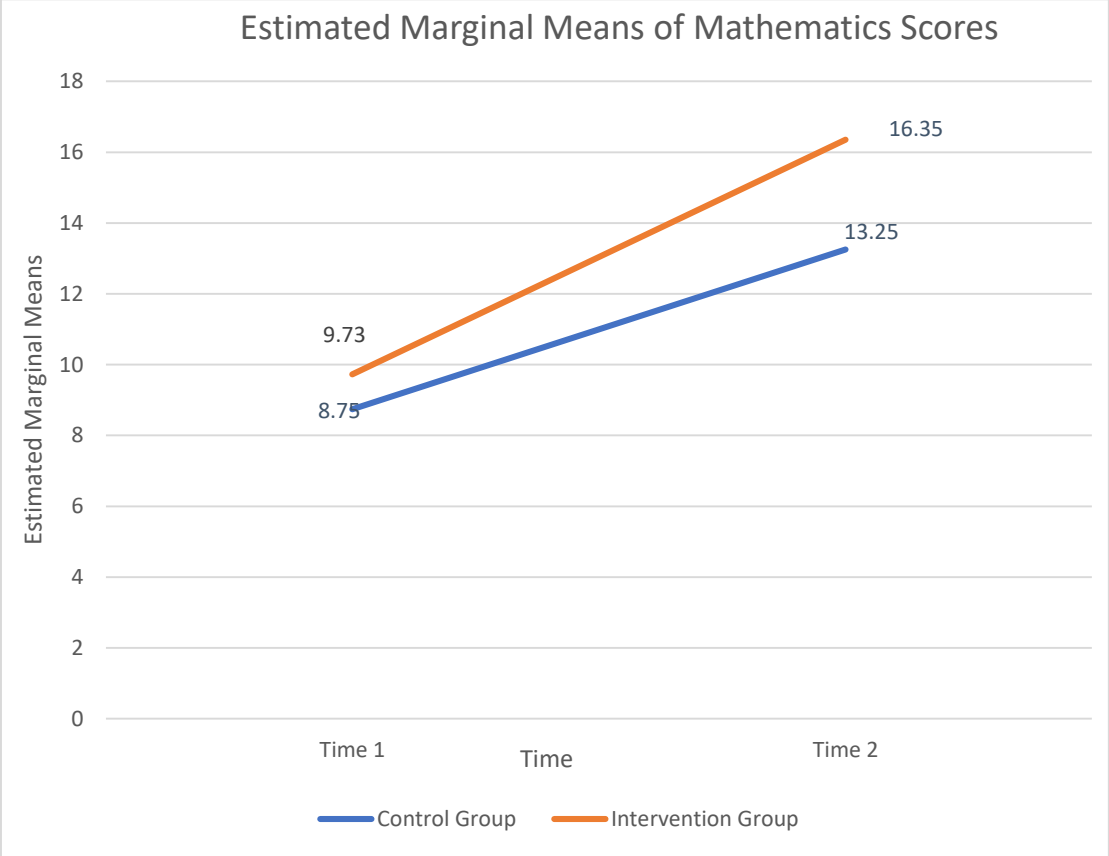

Figure 4.7.. Line chart showing estimated marginal means of mathematics scores

Figure 4.7 provides a line chart of the adjusted mean mathematics scores which have been amended to reflect age difference, explaining why these results are different from the raw scores provided above. It is clear to see from this plot that there is an interaction effect between the Group type (experimental and control) and the Time (pre -raw score and post -raw score). The main gain in mathematics scores for the PALS group was 6.6 compared to 4.5 for control group as set out in the ***Table***

4.4 below. It is true that the difference might be small, but it is statistically significant. Of most interest is the partial eta squared value obtained for Time that indicates a large effect size and suggests the contribution is significant.

The results indicate that RQ3 was supported and that engaging in peer tutoring programme (Maths PALS) results in improvements in mathematic for pupils with mild intellectual disabilities

Group	Pre	Post	Raw Gain	% Gain
Control	8.75	13.25	4.50	51
Pals	9.73	16.35	6.62	68

Table 4.4: WRAT 4 performance adjusted for age (estimated marginal means)

4.2.4 Result of Evaluation of the Effect of Peer Tutoring Programme (Maths PALS) in the Changes in Attitude Towards Mathematics for Pupils with Intellectual Disabilities

RQ4 was addressed by utilising an attitude questionnaire with the students in both the intervention and the control group; they selected their feeling about a topic through choosing one of three possible 'smiley faces'. The students in both groups were assessed prior to the beginning of the three-month teaching period by the trainee teachers in order to assess their attitude to mathematics, and again at the conclusion of the intervention period by the research assistants. The questionnaire involved children choosing the face and statements which best reflected their attitudes; these answers were then coded with a numerical value (1, 2, 3). Once the reliability of the instrument had been checked (section 3.3.8.3), the researcher also employed ANCOVA for the purposes of statistical analysis. As in the case of the WRAT-4 Maths subtests, the variable was Time; Time1 was the pre-intervention scores, with the post-intervention scores being referred to as Time 2.

On the attitudinal pre-and post-test raw scores, analysis of covariance were conducted associated with a mixed between- within subjects analysis of variance, one between-subjects (ANCOVA: condition), and one within-subjects (Time: pre vs. post) ANCOVA. This analysis can show whether the change in the attitude to learning mathematics over time is different for the two groups (interaction effect) while statistically controlling for an additional variable (Age).

Attitudinal Scores	Group	Mean	Std. Deviation	N
Pre-intervention Raw Scores	Control Group	25.48	5.236	27
	Intervention Group	24.23	5.094	26
Post-intervention Raw Scores	Control Group	26.52	4.933	27
	Intervention Group	32.38	2.593	26

Table 4.5:Descriptive statistics of attitudinal scores for intervention and control group from before to after the intervention

Table 4.5 provides descriptive statistics regarding pre-intervention and post-intervention attitudinal scores for each of the groups for their attitude to mathematics. The assumption of normality was met for the ANCOVA to proceed (refer to ***Appendix 15*** for details). The results of the ANCOVA analysis (refer to ***Appendix 15*** for tables) indicated that there was no significant interaction between Time and Age, Greenhouse – Geiser =.56, F (1,50) =.128, p = .72, η^2_p = .003. There was a significant interaction between Time and Group, Greenhouse – Geiser = 271, F (1,50) = 61.7, p < .0001, η^2_p =.56. The partial eta squared value obtained for the interaction between Time and Group suggests a large effect size of this result according to "the guidelines proposed by Cohen (1988, pp.284-7)" (Pallant, 2007, p.208).

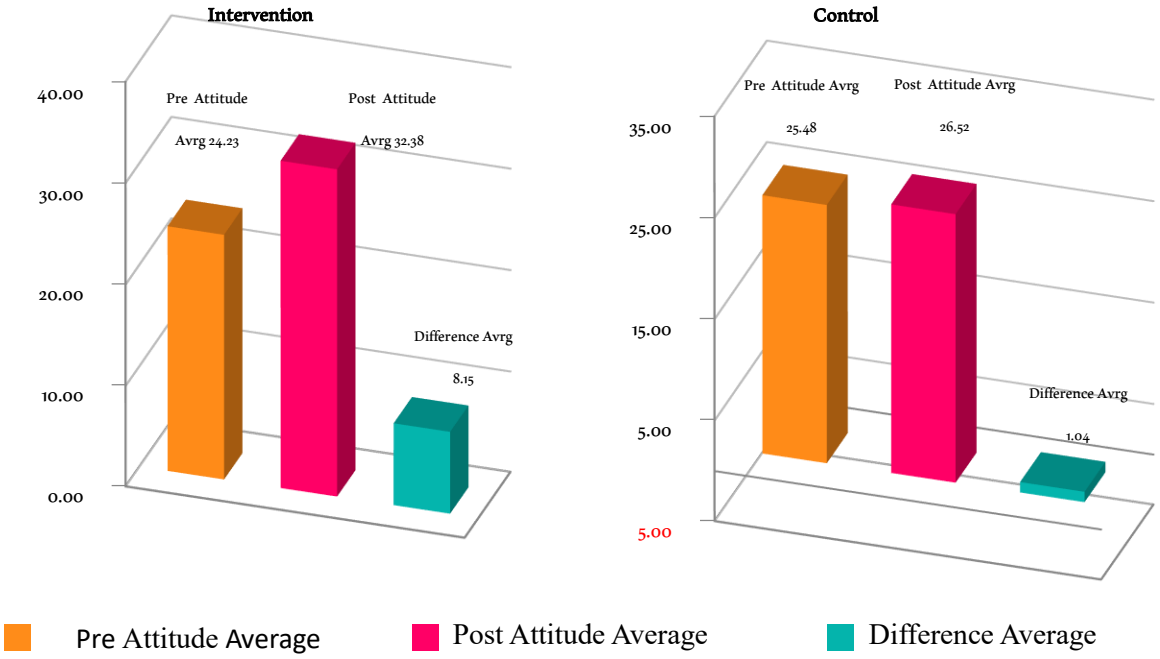

Figure 4.8: Bar chart showing comparison of improvement on attitude

The ***Figure 4.8*** clearly illustrates that both groups had approximately the same levels of attitude prior to the beginning of the intervention period. However, the attitude levels of the intervention group progressed significantly over the three-month period of the programme, increasing from an average of 24.23 pre-course to a post -course average of 32.38. In comparison, the control group had a pre-intervention period score of 25.48, rising to only 26.52 post-intervention. The control group progressed by 1.04 in terms of average attitude, in comparison with a greater increase of 8.15 for the intervention group. The line chart below shows the differential change in attitude mean raw scores over time.

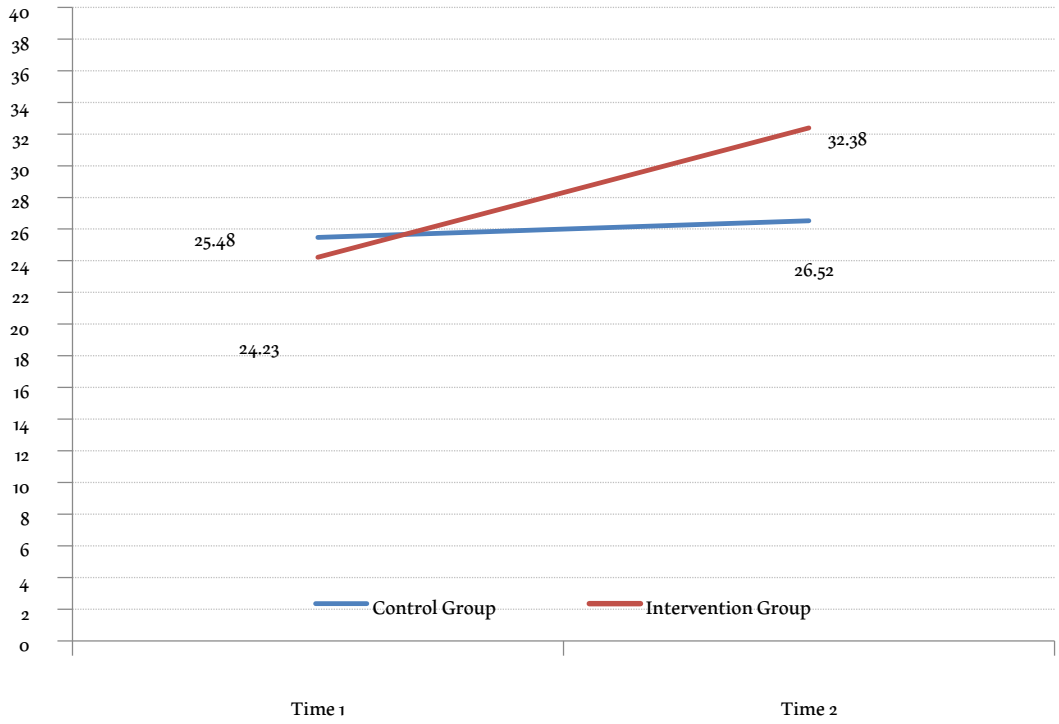

Figure 4.9: Line chart showing comparison of attitude raw scores between groups

The adoption of mixed between-within subjects ANCOVA allow to identify differences between the two groups. First the Levene's Test of Equality of Error Variances box was checked and in this case, it passed the pre-test but it did not pass the post test of the assumption of Sphericity ($p < 0.05$); therefore, the value that has been selected is Greenhouse – Geiser (refer to ***Appendix 15*** for tables). Of most interest is the interaction effects, so the Within-Subject box was used to support identifying the effect of Time and its interactions with Age and Group. These results are presented previously at the bottom of p.128.

The evidence suggests that when Age is controlled, there is a statistically significant interaction effect between Group type and Time, producing the following line chart:

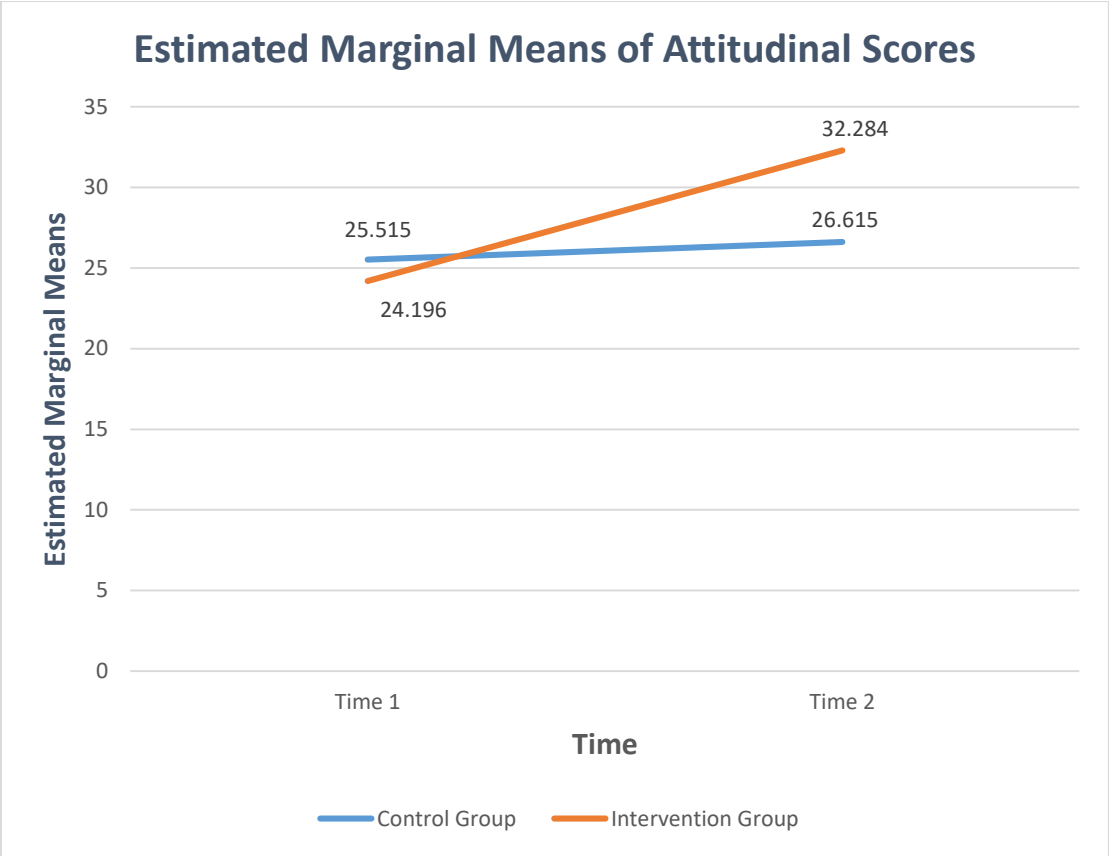

Figure 4.10: Line chart showing estimated marginal means of attitudinal scores

Figure 4.10 illustrates the adjustments score in attitudes towards mathematics that are evident from the questionnaire in both groups, which correlates with Bar chart 4.8. This plot provides evidence that there is an interaction effect between the Group type (experimental and control) and the Time (Pre -raw score and Post -raw score). ANCOVA analysis recommended a correction to group means to take account of the impact of age. These estimated marginal means are summarised in ***Table 4.6*** which shows that the main gain in attitudinal scores for the PALS group was 8.08 compared to 1.11 for control group.

Group	Pre	Post	Raw Gain	% Gain
Control	25.51	26.62	1.11	4.4
Pals	24.20	32.28	8.08	33

Table 4.6: Attitudinal scores adjusted for age (estimated marginal means)

The results demonstrate that RQ3 was supported and that engaging in the peer tutoring programme (Math PALS) result in positive changes in the attitude of pupils who have mild intellectual disabilities towards mathematic

4.2.5 Summary

This section has reviewed the data collected for the experimental part of the study. The evidence suggests that the various tests which have been applied during the course of the study are fit for purpose. The results show that the trainee practitioners gained knowledge with regard to peer tutoring as an approach towards teaching and learning. Controlling for pupil's age helped to show that differences in the groups related to the intervention were statistically significant and the effect size was large. The pattern of test scores in mathematics illustrate that there were greater improvements for the pupils who were exposed to the Maths PALS programme, and that their attitudes towards the subject also improved over the three-month period. These results are endorsed by the data covering the fidelity of the implementation of the Maths PALS programme; as the three-month period progressed, the students' ability to implement and use the Maths PALS system correctly improved, with the trainee practitioners showing similar levels of improvement.

4.3 Section Two: The Perspective of Peer Tutoring Programme (Maths PALS) and its implementation and the outcomes for pupils and trainees

The interpretive section of the results provides a record of the data from a series of semi-structured interviews conducted at the conclusion of the course with the five trainee teachers who taught the intervention group. ***Appendix 16***, ***Appendix 17***, ***Appendix 18*** and ***Appendix 19*** contain an example of an interview transcript, example of the coding that I used for my thematic analysis and some copies of organising of initial and refined codes on data drawn from the interviews. This section of the findings is based upon commonality and differences in perceptions. It will be structured according to the themes that have been identified, as well as interpretations provided by the researcher, in answer to the question 'What perception do trainee teachers have of the peer tutoring programme (maths PALS), its implementation and the outcomes for pupils and themselves'?

During the course of this section, interviewees will be referred to as Abeer, Afnan, Amal, Noura and Nada. It is pertinent to note that some of the contents of each section could easily have been placed in other sections as there are considerable areas of overlap, and that – somewhat inevitably - there are instances of repetition as a result.

Nine overall themes have been identified as a result of the analysis of the trainee interviews; these are categorised into emergent sub-themes, and set out in the table below.

Main Theme	Sub-Theme
Experience of the training course and the application phase	• *guidance/follow-up support* • *enjoyment of the experience* • *helpful materials* • *content of the training course*
The role of the participant practitioners	• *assessment* • *reinforcement/encouragement* • *supervision/guidance/feedback/monitoring* • *students training* • *students pairing*
Positive impact on participant practitioners	• *feeling successful as a teacher* • *changing routines* • *changing perspectives to mathematics* • *creating an atmosphere of enthusiasm which motivates* • *learning that SEN students have 'tremendous ability'* • *easing the pressure on practitioners* • *learning new methods to add to previous experience* • *feeling confident and capable*
Potential challenges	• *children's need for more freedom in terms of creating a dialogue* • *difficulties of mathematics as a subject* • *difficulties in training SEN students* • *not allowing pairs to change the partner* • *preparation requirement in terms of effort and time*
Comparison of PALS with other teaching methods	• *PALS being better in some respects* • *other methods being better in some respects* • *no conflict between PALS and other teaching methods*
Positive elements of PALS	• *helping students to engage with the task* • *helping students to work independently*

	• *aids class and behaviour management* • *motivational approach for students and practitioners* • *useful approach with SEN students* • *creation of a cheerful atmosphere in the classroom* • *fun and enjoyment* • *helpful materials*
Student outcomes	• *Social skills* ❖ *caring* ❖ *peer relationships* ❖ *ability to work together* ❖ *social interaction* ❖ *patience* • *academic skills* • *positive attendance and attitude to learning* • *ability to interact with and tutor each other* • *self-confidence*
When PALS can be used	
Future use	• *sharing their experiences with colleagues* • *plans to apply this approach officially in the classroom* • *benefits from PALS in other subject areas* • *peer tutoring course could be taught at university* • *plan to apply it when becoming a teacher*

Table 4.7: Main themes and sub-themes as a result of the analysis of the trainee interviews

4.3.1 Experience of the Training Course and the Application Phase

This theme can be categorised into four subthemes: guidance/follow-up support, enjoyment of the experience, helpful materials and the content of the training course itself.

4.3.1.1 *Guidance/Follow-up Support*

The preparatory course was highlighted as being particularly useful as it was practical in nature. Abeer(Q7) stated that she found the role-playing particularly

useful in terms of understanding the strategy more quickly, as a result of being asked to adopt the role of both the teacher, the pupil teacher and the pupil tutee. In addition, she noted that experimentation in the various roles has facilitated a greater understanding of the PALS programme which was supplemented by the video presentations that form part of the course. She also stated that designing colourful posters about PALS steps proved to be of great benefit. Amal(Q7) also made positive comments about the helpful nature of the training course, particularly with regard to the 'extremely helpful' videos and the 'clear and detailed' manual. Afnan (Q7) applauded the practical nature of the course, which provided a detailed explanation of how to apply the programme, which inspired her to continue her preparations at home. She explained that she read and reread it quietly which enabled her to better understand the contents and that this, allied further guidance, feedback and follow-up from the supervisor enabled her to implement the programme during the course of the first few weeks. Noura(Q7) commented that the materials, written explanation, and videos were very helpful, as was the 'inventive teaching method' adopted by the course provider and that working together '… as we would in a classroom" made things easier. Noura (Q7) also made comments about the usefulness of the resources which included 'folders, materials and posters for the PALS rules.' Nada (Q7, Q11) stated that the clear, comprehensive workshops were useful and concepts were well-explained.

Guidance and support were also provided during the application phase of this study. This was particularly evident in the first few weeks during which group discussions were held, as well as individual sessions with the programme supervisor and visiting tutors. These were found to be helpful in dealing with questions that were raised and the difficulties that were encountered (Abeer, Q7), and in following up the contents of the programme (Afnan, Q7). Nada (Q7) also referred to the usefulness of the manual, PALS videos, materials in terms of the support they offered, and as frequent points of reference, when engaged in the application process.

4.3.1.2 *Enjoyment of the Experience*

Each of the participants stated that they had enjoyed the training experience, in that it provided them with important experiences which would allow them to empathise with the children who were engaging with this approach in the classroom. Afnan was enthusiastic about the programme, stating that it really appealed to her, and that she liked the PALS materials very much, making it a memorable experience (Q9, 10).

Nada (Q7) stated that she had really enjoyed the training programme, particularly in light of the clear, comprehensive workshops and the materials, inclusive videos and the manual, which formed part of it.

Amal (Q10) stated that she had '… really enjoyed being part of the programme', whilst Noura(Q8a) commented that delivering this programme was her first real experience of teaching, which was initially quite scary and tense, but that she was now '… more comfortable and enjoying the experience.' Nada (Q8) was highly delighted that she had been able to enjoy '… this brilliant programme', stating that she felt pride and fulfilment at the end of the programme on '… seeing how much the students had improved in the mathematics and social skills.'

4.3.1.3 *Helpful Materials*

Further comments were offered in support of the helpfulness of the materials that were contained within the training programme. Abeer (Q7, endorsed by Amal) stated that the detailed manual was extremely helpful, as were the role play sessions, whilst Afnan(Q7) commented that the manual provided her with an opportunity to continue to immerse herself in the programme at home, and to undertake checks in addition to the help provided by the supervisor. Noura (Q7) stated that the training and resources, including the folders, manuals and posters for PALS rules, were extremely helpful, with Nada (Q7, Q11) agreeing that the materials were useful and well-explained to the extent that she felt confident in implementing the process.

During the application phase, Amal (Q11) observed that the materials were so accessible that it made the implementation process a relatively straightforward one. Nada (Q7) also referred to the usefulness of the videos, materials and manual in terms of their being a reference point during the application stage.

4.3.1.4 *Content of the training course*

All of the participants made comments about the content of the training course, with no one making any adverse comments at all. Each commented about the fact that the way in which the training course was approached, provided them with a good understanding and grasp of how the system worked, and that the practical side of its delivery paid dividends for their understanding. This was particularly evident in the comments about role-play (Abeer, Q7). It was also apparent that this approach had been an enjoyable experience, supplemented by the materials that were available (materials, manual, folders, PALS rules posters) which enabled the participants to

do further research and fully come to terms with how this approach towards teaching and learning could be applied in the classroom.

4.3.2 The Role of the Participant Practitioners

The following theme is related to the role of the participant practitioners and was categorised into five sub-themes: assessment, reinforcement/ encouragement, supervision/guidance/ feedback/ monitoring, students training and students pairing.

4.3.2.1 *Assessment*

Assessment is seen as a vital role by all participants. Abeer(Q1) observed that 'the teacher can adopt this strategy to monitor the students and the performance levels and to identify the strengths and weaknesses of each student in their arithmetic skills.' In addition, she stated that when placing students into pairs, it is important to place them in such a way as to encourage them to interact with each other to facilitate learning, by ensuring that one is a high performing student while the other is a lower performing student (Q2).The point with regard to pairings is taken up by Nada(Q2), who states that the pairings are important in that both need to have knowledge of the respective roles and tasks involved in the PALS process, sometimes necessitating placing more able pupils with the less able ones.

4.3.2.2 *Reinforcement/Encouragement*

This system is designed to encourage children to support and reinforce each other's efforts in order to learn with and from each other. The principles of reinforcement and encouragement are also vital for students '… through the teachers use of smiley faces, as well as providing extra support on the effective implementation of the PALS steps' (Abeer, Q2). Afnan (Q2) mentioned that it is the teacher's role to observe and monitor the students as they work, '… as well as to provide feedback and give reinforcement using additional smiley faces for groups that make more effort and work well as a team.' The point about reinforcement, motivation, supervision, guidance and feedback is picked up by Noura (Q2), who commented that the teacher has an enormous role to play in administering and supporting students who are using peer tutoring approach towards teaching and learning. Support for the tutoring student is a point which was highlighted by Nada (Q1), who believes that it is important that they not be left completely by themselves in their attempts to ascertain meaning, and that reinforcement of both parties should take place to reinforce good work as individual learners and as groups of people (Q2). Nada (Q2) also advocated

the use of smiley faces to reward the efforts of the students during the course of providing feedback, with additional rewards being available for the best performing groups.

4.3.2.3 *Supervision/Guidance/Feedback/ Monitoring*

The participants identified the fact that PALS can be utilised to monitor students (Abeer, Q1), and that it can be used in developing students' ability to be self-dependent, restricting the practitioner's role to that of offering guidance and supervision (Abeer, Q2, Q6). Afnan (Q2) made the point that practitioners observe and monitor children, giving them feedback, which is a point also made by Amal (Q2). In addition, she stated that the practitioner supervises the activities which the children carry out in the form of a game, which sees each member of the pair adopting specific tasks and responsibilities according to their role (Q1). The supervisory role is particularly stressed by Noura(Q2), who regards the teacher's role as 'massive' in terms of providing not only supervision, but guidance, feedback and motivation, in order for learners to be able to become independent in their work (Q8a).Nada(Q1, Q2, Q5a) stressed the role of the teacher in providing training, guidance, monitoring and feedback to the pupils as they engage with this form of teaching and learning.

4.3.2.4 *Students Training*

When implementing any new system or approach towards teaching and learning, the training of the students rests in the hands of the practitioner in charge of the new intervention. It is therefore important that students are aware of the need to work together in accordance with specific guidelines (Abeer, Q1) and that they are able to apply those principles without needing any help (Abeer, Q2). It is through this training that practitioners ensure that individuals are self-dependent, so they need to monitor their ability (having trained them) to work independently (Abeer, Q2). Children also need to learn how to tutor and to explain concepts to other children (in their capacity as a teacher) and use correction procedures effectively; they also need to be aware of when to switch roles, the responsibilities involved in each role, and how best to use reinforcement techniques such as smiley faces (Afnan, Q2; I5, Q2). Afnan (Q4b) noted that the training involved was problematic in that the pupils did not know the rules or understand their roles which took a good deal of time and effort. However, although it was a mess, with the practitioner being on the point of giving up (Q10), '… they soon got used to the programme', eventually showing marked improvements

in their behaviour during PALS lessons and their lessons with the class teacher (Q8). The training enabled the children to work independently (Amal, Q8), although in the initial stages the training had to be repeated on a daily basis in order for them to become proficient (Amal, Q9). It was also seen to be important to provide pupils with the 'right training' so that they were able to help others and solve problems (Noura, Q8a), which serves to build up the trust that is necessary between the pairs (Nada, Q1).

4.3.2.5 *Students Pairing*

Inevitably, responsibility falls to practitioners to place children in groups which would allow them to work best. As mentioned above, Abeer (Q2) believes that practitioners must keep several things in mind when they are placing pupils in pairs, finding the right balance in terms of mathematical ability, as well as personalities and characters. Afnan (Q4b) made the point that successful pairing was only possible once the initial training process had been completed to the extent that tutors understood the different roles that they had to adopt. The pairing of students was also stressed as one of the key principles of PALS (Amal, Q2), particularly with regard to the understanding of roles and responsibilities, when to switch roles and the general working practices for successful paired working. Noura(Q2 was acutely aware of the fact that the teachers needed to consider a number of different issues when selecting each pair – 'for example, the counting ability of children in the mathematics skills and the chemistry between them.' This practitioner was candid enough to share an important personal realisation – 'you get to see the top-level student teaching a low performing peer… I actually realised how capable and happy children were when they were engaged in peer tutoring' (Q5), and she also noticed the positive impact that working in pairs had on each of the children (Q8).

4.3.3 Positive Impact on Participant Practitioners

The positive impact on participant practitioners can be categorised into eight sub-themes: feeling successful as a teacher, changing routines, changing perspectives to mathematics, creating an atmosphere of enthusiasm which motivates, learning that SEN students have tremendous ability, easing the pressure on practitioners, learning new methods to add to previous experience and feeling confident and capable.

4.3.3.1 *Feeling Successful as a Teacher*

One of the most important aspects of any research and/or reflective process for practitioners is to feel that they have been successful in their role as a teacher. Abeer (Q13) indicated that she had felt successful in the sense that she would be prepared to use the strategy when she became a teacher, and that this was the result of the programme's clarity, its impact on classroom organisation and the fact that it was fun. Afnan (Q8) indicated that she considered the application of the PALS programme a personal success 'because the head teacher was pleasantly surprised with my students and praised how well they engaged on task and how well they interacted while working in groups.' Amal (Q8) stated that the improvements in students' Maths attainment levels made them feel personally successful. Noura (Q8a) commented that she felt more confident and proud of herself as a result of this experience. Nada(Q13) stated that she measured '… the success I achieved as a teacher against the achievement of my students in terms of learning mathematics skills and interaction and enjoyment of the things they do in class … This is indeed what makes my day.'

It is pertinent to point out that any of the comments contained within this section above could be perceived as each individual being successful as a teacher, in view of the fact that they have recognised specific, positive aspects of introducing a new and innovative process to children in their classes.

4.3.3.2 *Changing Routines*

A positive impact of the introduction of this method of teaching and learning has been to cause one practitioner to change and/or adjust her methods in the teaching and learning of mathematics. Amal (Q13) stated that adopting this method with the children was a '… routine-changer for teachers who are used to the spoon-feeding technique where they do all the talking.'

4.3.3.3 *Changing Perspectives to Mathematics*

The experience of applying the PALS programme in the classroom has had the effect of changing one participant's perspectives about mathematics entirely; Nada (Q14) was open enough to admit that she did not really enjoy teaching maths and, having realised that the programme would focus upon maths skills, she expected to face countless problems in its application. She had mixed feelings, as on the one hand she was looking forward to applying the programme, but was nervous about using it

within a subject she was not keen on. However, Nada explained: 'To be honest with you, I have changed my mind after the delivery of the programme because I would definitely do it again with the same subject… It was an eye-opener for me and changed my perspective altogether about the mathematics subject.'

4.3.3.4 *Creating an Atmosphere of Enthusiasm Which Motivates*

Out of the five people who were interviewed, one mentioned the benefits of creating an atmosphere of enthusiasm. Once the children had a firm grasp of the PALS system, there appeared to be an impact upon their motivation towards learning – 'it does really create an atmosphere of motivation for learning and enthusiasm to be part of the class' (Nada, Q5).

4.3.3.5 *Learning that SEN Students have 'Tremendous Ability'*

One of the results of introducing a new teaching method to the practitioners was that it made them reflect upon their attitudes towards those who have special needs. 'I learned from this experience that these children have a tremendous ability to learn that should not be ignored … I felt extremely pleased seeing my students tutoring each other and interacting with one another, which reflected on their personalities … It is an achievement for all of us '(Afnan, Q8). At the start of the process, Amal (Q10) was wary - and indeed, sceptical - that the PALS approach might not be suitable for SEN children, as they have specific individual differences, as well as issues with regard to their social skills. Amal also stated that they had found difficulties in the beginning with managing and working well with students in groups – 'but honestly, I found it very suitable for them as soon as they started enjoying the PALS routines, like announcing the start of the PALS session and sitting together to work in pairs, as well as distribution of folders… It was such a memorable and interesting experience.'

4.3.3.6 *Easing the Pressure on Practitioners*

Often when introducing a new programme or system, practitioners' express concerns with regard to additional responsibilities and workload. This was not the case with the participants here. Abeer (Q9) expressed the view that, on the contrary, it released some pressure from the teacher's shoulders once the students had mastered the techniques required in Maths PALS - 'I find it easier than the discussion method, as it always left me to do all the talking and it is also exhausting.' Once the initial phase of training had been completed for the children, '… it became easy and less

demanding.' Amal (Q9) stated that it didn't really add to the practitioners' workload or responsibilities as '… all of the materials (scripted lessons, activities "Game boards" and folders) related to the programme are readily available.' Nada(Q5) made similar comments to Abeer, stating that once the initial training with the students had been completed, it relieved her workload, creating an enthusiastic atmosphere for learning in the classroom. Furthermore, once the system was being used, it allowed her to concentrate on giving guidance, monitoring and supervising the students, thus diminishing her workload (Q5a, Q9).

4.3.3.7 *Learning New Methods to Add to Previous Experience*

Even though there were some comments about the difficulties experienced when training the children in the use of PALS methods, all of the participants stated that they had enjoyed learning this new teaching approach. Abeer (Q8) stated that she had enjoyed it and learnt a good deal, '… added it to my academic and hands-on experience' and concluded that '… once I become a teacher, I will put it into practice' across a number of subject areas, even when reading the Quran. Afnan (Q8) regarded it as a great addition for her personal CV in that she had experienced the process of learning and applying a new, useful teaching method (echoed byAmal, Q8). Amal(Q9) confirmed that from the outset, the whole programme really appealed to her, that she liked the materials and she felt that it was a good idea, which was probably '… the reason why I enjoyed it with students during the application stage.'

4.3.3.8 *Feeling Confident and Capable*

It was apparent from the participants' comments that, as time went on they felt increasingly confident and capable of utilising this strategy for the teaching and learning of Maths. Abeer(Q14) stated that she felt she had perfected the system and was capable not only of applying it again, but of training other students in its use. This aspect of training was further extended by Afnan (Q15) to their teaching colleagues, through her offering to give guidance and training in its use in their classroom. Amal(Q14) commented that she felt that she had gained the necessary experience and skills to run the programme and that her level of confidence was increased by positive comments made by the classroom teacher when she attended the PALS class. Rising level of confidence was also pinpointed by Noura (Q8a) who stated that she had grown in confidence with regard to her ability to be a good teacher through knowing '… when to intervene to help the student and when to hold back

and give her a chance to try.' She also stated that, in spite of initially feeling scared and tense as a result of it being her first experience of teaching, she now feels more comfortable and is enjoying the experience.

4.3.4 Potential Challenges

In respect to the potential challenges of the PALS approach, five sub-themes were identified: children's need for more freedom in terms of creating a dialogue, difficulties of mathematics as a subject, difficulties in training SEN students, not allowing pairs to change the partner and preparation requirement in terms of time and effort.

4.3.4.1 *Children's Need for more Freedom in Terms of Creating a Dialogue*

This new approach towards teaching and learning of mathematics proved to be a challenge for one of the participants in that she wanted children to be '… given more freedom in terms of interacting with their peers and creating a dialogue with others in the classroom regarding a certain academic task without being prompted […] I would also like them to solve any part of an activity without any restrictions' (Noura, Q4). According to this trainee's opinion, the PALS approach can be too limiting, in that the structure does not allow learners to be creative in their thinking.

4.3.4.2 *Difficulties of Mathematics as a Subject*

Noura's view provided above that the implementation of PALS is challenging because she found the PALS materials to be too structured could also be related to her view that Maths is a difficult subject. In fact, she mentioned on three occasions that she does not like Maths because it is difficult (Q4, 10, 14). Another evidence that supports this claim is provided in her comment that since Maths is a difficult subject, so theoretically, if the strategy was applied to reading it would be far easier to implement (Q 10).

4.3.4.3 *Difficulties in Training SEN Students*

The process of administering the Maths PALS approach was made more challenging as a result of some issues related to the training of SEN students in its use. Afnan (Q10) stated that she could train the children one day '… but [they] turn up the next day not remembering what they had learnt… So, I have to go through the whole process again.' In spite of this, she commented that the programme is suitable for SEN children. Noura (Q9) emphasised that it took extra effort with individual students

to train them properly and, similar to Afnan, she highlighted the need to spend more time and effort to explain and train students to ensure that they had properly absorbed information, and understood how to utilise the system effectively (Q10). These comments were echoed by Nada(Q10) who found the training the most difficult part of the application process '… but [I] found the manual very helpful for me because it contained explanations on how to deal with children and what to do in each training session.'

4.3.4.4 *Not Allowing Pairs to Change the Partner*

Noura (Q4) was the only participant who raised her concern regarding children not being allowed to select their own partners. The system requires the practitioner to create pairs from the beginning of the process, with each pair having to spend at least three weeks working with each other; 'pairs are not allowed to change every time there is a PALS session… One day, I was asked by one of my students 'Why can't L work with A and I get to work with H?'

4.3.4.5 *Preparation Requirement in Terms of Effort and Time*

Each of the participants indicated, particularly in the initial stages, that there was a great deal of effort required in training the students in order to use the Maths PALS efficiently. For example, Afnan (Q4b) highlighted that the training demanded a good deal of effort and time over a 10-day period and that sessions would last for an hour at this stage of the implementation. However, she confirmed that this was only at the beginning of the application stage and that once the children got adapted to its use, it became easier (Q9). Furthermore, she was keen to use it in the future (Q14). Amal (Q9) echoed these thoughts with regard to the time and effort taken over training at the beginning of the process and also the benefits having undergone the training process. Noura (Q9) stated that '… it used to take so much of my time… I think I used to spend 55 minutes, if not a bit longer than that, especially in the first few sessions… It took extra effort as each student had to be taken individually and given as much training as anybody else.' Nada (Q10) noted that the training process was the most difficult part for the students, but that the trainees have found the manual very helpful as it was quite explicit in explaining how to deal with children and what to do in each specific training session – 'I started step-by-step training and explained everything one at a time until they were able to absorb it… This took a bit of time, but they were eager to start nonetheless.' This type of patient persistence was

demonstrated in comments by Noura (Q9) in respect to one student who was having difficulties in understanding the system and its explanation; the practitioner continued to explain using different strategies including the student observing someone else being taught the same method and although it took some time and intensive training '… the process became easy and no longer required effort… On the contrary, the mathematics lesson became more enjoyable than ever before.'

4.3.5 Comparison of PALS with Other Teaching Methods

Comparison of PALS with other teaching methods was specifically addressed in Question 4 of the interview. The findings were categorised-into three sub-themes.

4.3.5.1 *PALS Being Better in Some Respects*

Abeer stated that PALS was better than the other strategies that they had previously used (discussion and dialogue methods), and that the students were enthusiastic about it. She also added that she noticed how much the students enjoyed PALS, which led her to believe that it was a better method than any other she had used before. In her opinion, this was because 'students enjoy learning using educational play.' Afnan commented that she used collaborative learning previously but that PALS was more effective in enhancing mathematical performance, and that the pre-prepared materials contributed to positive interaction and dialogue between students when they were engaged in set tasks. She also stated that the interaction was the catalyst for understanding, in that each individual gained knowledge and reinforcement from adopting both the role of the tutor and the tutee. It was also her contention that this system benefited their academic and social skills, in that their peers were often better able to explain concepts in a way that children were able to understand, thus removing barriers to learning (Q13). Amal observed that the students were enthusiastic about the programme, that these methods allowed children to interact well with each other and that they appeared to be responding better to these methods than those that are traditionally adopted for the teaching of mathematics (spoon-feeding). Noura was of the opinion that this approach improves children's levels in mathematics, but also develop their ability to interact with each other, thus impacting positively on their social skills. Nada stated that she had previously used self-modelling, video modelling, discussion, dialogue and cooperative learning; however, she expressed the opinion that PALS was a novel and comprehensive method which 'brought students to life,' encouraged their

enthusiasm and motivated them to learn through utilising gameplay and the process of interacting with each other – she felt that it was ‘a complete package.’

4.3.5.2 *Other Methods Being Better in Some Respects*

Afnan (Q4) believed that a cooperative approach was more holistic in enabling students to put their learning into practice, allowing them ‘… equal shares in the various activities.’ Amal was critical of PALS in that it focuses upon a specific skill that one of the students may find difficulty in understanding. This places the more knowledgeable student in a position where he/she has to provide support for the weaker students to overcome this difficulty. She found collaborative learning, which involves students working together as a group (thus encouraging everyone to contribute towards the task) to be more helpful, in that individuals are more able to participate in accordance with their ability level. Amal also thought that cooperative learning has the advantage of low maintenance in terms of training, whereas PALS requires a substantial amount of input from the outset and that it takes a good deal of time and practice with the techniques in order for the students to become proficient. Noura was of the opinion that cooperative learning, which allows children to learn through play, provides them with the opportunities to interact and carry out required tasks. She also stated that other teaching methods do not require as much effort as PALS in terms of the training of children. In addition, Noura felt that other methods could be more effective in that they take less time to train the children and provide them with more freedom to work in different ways. Other methods could also provide practitioners with the ability to diversify activities as they felt necessary, rather than following a specific programme.

4.3.5.3 *No Conflict Between PALS and Other Methods*

All of the participants indicated that there was no conflict between PALS and other teaching strategies. Abeer and Nada stated that this approach never conflicted with other methods, as did Afnan although they pointed out the complexity of this approach at its initial stages. Amal also indicated that there was no conflict between PALS and other teaching methods, preferring to comment upon the positive, enthusiastic reaction of the students.

4.3.6 Positive Elements of PALS

Many positive elements of PALS were identified by those who were interviewed; these are discussed under the eight sub-theme headings below.

4.3.6.1 *Helping Students to Engage with the Task*

One of the prevalent issues with SEN children is related to their concentration and their propensity for being easily distracted. The PALS programme was seen to have a positive effect on the students in this regard in that they were able to '… work together on a specific activity without being distracted' (Abeer, Q13). The programme was also seen to '… engage and motivate students to collaborate with each other and accept each other' (Nada, Q1), thus allowing each to adopt the roles of tutor and tutee. Nada (Q6) also stated that students were able to become fully engaged without any assistance, becoming reliant only upon themselves to the point where they would retrieve the folders for themselves, work on the activity sheet and return the folders to the correct place without prompting. Increased engagement and motivation can also be seen as a result of individuals spending less time to solve specific exercises (Q8) and the keenness of practitioners to make use of every spare minute of the day engaged in PALS activities (Nada, Q10).

4.3.6.2 *Helping Students to Work Independently*

Self-reliance and independent working was a positive element of PALS which was highlighted by Noura (Q8a). She felt that the programme was useful '… in terms of giving my pupils the right training and trying different strategies, as well as progressing with them from prompting to using hints and then gradual concealment to help them towards working independently and developing the listening and observation skills.' Nada (Q6) picked up this theme – 'The best thing about the programme is that it helped teach the students how to rely upon themselves.'

4.3.6.3 *Aids Class and Behaviour Management*

The PALS approach towards teaching and learning was seen as an aid to class and behaviour management. Abeer (Q12) stated that she was really keen on the programme, so much so that she passed it on to her sister, who was teaching normal students at different schools and was having problems controlling some misbehaving students – 'she once complained that the time allocated for the lesson would be wasted trying to get them organised and soon as she is about to start, there is hardly any time left for teaching.' This led her to discuss the PALS strategy with her sister and to provide her with some materials, which were gratefully received. In addition, Abeer (Q13) stated that Maths PALS had enabled her to organise the classroom better. A comment with regard to better time management was made by Afnan (Q9),

whilst Nada (Q8) indicated that as a result of using the programme, some children's behaviours were modified to the extent that some behaviours such as making fun of each other and not participating were greatly reduced.

4.3.6.4 *Motivational Approach for Students and Practitioners*

Motivation for both students and practitioners was a point that was highlighted by three of the five participants. Amal (Q13) stated that the approach was '… quite motivational for the students and it is fun for all of us.' Noura (Q5) asserted that the use of smiley faces was a source of motivation for the students and created a positive atmosphere in the classroom. In addition, she referred to the approach as being quite motivational for her, giving '… me additional assets in teaching and instruction to be able to make it easy for my students to understand the concept' (Q8a). She also felt delighted and further motivated as a result of the fact that she had seen a gradual improvement in children's performance (Q14). Nada (Q1) also confirmed that the system '… engages and motivates students to collaborate with each other' and to accept their peers. She also referred to the innovative nature of the PALS system which arouse the interest of the children, particularly with regard to gameplay (Q4).

4.3.6.5 *Useful Approach with SEN Students*

Afnan (Q4) commented that '… the structured format of a series of questions requiring answers by definition encourages and supports interaction which is a skill that is often absent in the SEN students.' She believes that this 'enforced interaction' is a catalyst which motivates them to respond positively to each other and provides them with a sense of satisfaction. Furthermore, she believes that this approach is appropriate for SEN students who need to be encouraged to interact more openly with those around them. This approach is also seen to be valuable both in terms of academic development (Amal, Q6) and social skills, such as listening and observation (Noura, Q8a).

4.3.6.6 *Creation of a Cheerful Atmosphere in the Classroom*

The PALS approach was also seen as supporting the creation of a cheerful atmosphere in the classroom (Afnan, Q4). Amal (Q13) made a similar observation, putting this down to the fact that students '… get to practice the role of the teacher… [which] can reflect positively on the atmosphere in the class.' Nada (Q1) also stated that PALS '… creates a friendly and sociable atmosphere in the classroom', as well as making students excited and providing '… a fun atmosphere in the classroom'

(Q5a). This participant also commented that they liked the fact that students could sit together and work in harmony with each other '… which has created a lovely atmosphere of familiarity and closeness in the classroom' (Q8). She also expressed the opinion that the atmosphere in the classroom reflected not only on the students, but also on the teacher, particularly with regard to the presence of fun in the form of gameplay, entertainment and keenness on the learning skills (Q13), which was enhanced by the use of smiley faces (Nada, Q5).

4.3.6.7 *Fun and Enjoyment*

Fun and enjoyment was an aspect which was highlighted as being important. 'For the students, everything was clear according to specific steps… The same applies to the programme which was flowing, easy, light and fun' (Abeer, Q5). Abeer also reported that she liked the fun which PALS created in the classroom in terms of the interaction between students (Q6) and that she enjoyed the fun that she experienced with her students in the application stage (Q13). Afnan (Q6) stated that she found the programme really enjoyable and that it made Maths lessons specifically very enjoyable (Q9). Amal observed that this approach is fun for children because they like gameplay (Q6), and that, after a difficult beginning, it became fun (Q8). Noura highlighted the fact that the students enjoyed the use of smiley faces and the activity sheets (Game boards) which included images and pictures, as well as adopting the role of tutor (Q6). Nada was very enthused by the novelty of the PALS approach, feeling that it '… really brought the students into life and spurred their enthusiasm and motivation whenever I mentioned to them that we would be learning with PALS… They would get so excited whenever I decided to engage them in some gameplay with PALS.' She also reinforced the notion that PALS provided a fun atmosphere (Q5a) and highlighted the fact that the children enjoyed the role play, particularly that of the teacher and being able to help each other – 'for example, whenever they thought a student deserved to be given the title of 'student of the day', they would give her a smiley face…' (Q6). Nada (Q13) also pointed out that the fun aspect that is generated in the classroom is reflected on both the students and the practitioners.

4.3.6.8 *Helpful Materials*

The structure and materials for the implementation of the PALS programme were found to be very valuable. Abeer (Q5) stated that the programme was well organised and simple, containing clear strategies and guidelines which enabled them not to

have to make '… much of an effort to prepare for the PALS session'. This was the result of everything being clearly explained and detailed for the practitioner, including the '… day-to-day student training sessions which are described in the teacher manual.' The ease of implementation is also supported by the fact that the PALS activity sheets (Game boards) are all readily available, offering a variety of activities covering all mathematical ideas. This participant also assured that she would implement this programme when she became a teacher because it is clear and she does not find it difficult (Q13). As mentioned above, Afnan (Q4) is of the opinion that the routine structure of the approach helps to support SEN pupils in the process of interacting with other people, and that the format motivates them to engage with others, thus providing a sense of satisfaction for them. Afnan (Q6) also enthuses about the use of smiley faces by fellow students to reinforce peer learning, thus providing further motivation to learn - the novelty factor provides increased levels of enthusiasm and motivation through having praise given to them by one of their peers.

The structure of the materials was also found to be useful in terms of students interacting in order to discuss the problems that they were facing (Amal, Q4), as well as helping the practitioner as a result of activity sheets being readily available – 'the teacher only has to choose what suits the levels of her children before going into the application process' (Noura, Q5). The materials were also praised by teachers and the school principal who attended one of the PALS sessions, where they were also struck by the levels of interaction between the children (Noura, Q5). This participant found that the organisation of the folders helped the children in terms of their ability to be self-reliant (Q5). In addition, she stated that she found the materials, particularly those containing pictures, very useful, although she had to bring in some materials when illustrations/pictures were absent from the activity sheets (Game Boards) (Q10). Nada (Q6) stated that she liked the Maths activity sheets because 'they offered variety and made it easy for me to select the activity consistent with the students' abilities without me exerting any extra efforts.' She also commented that the children responded well to the folders and the notion of its different sections (old and new), as well as the use of smiley faces as a part of the activities.

4.3.7 Student Outcomes

The Maths PALS system appears to have had a number of important benefits for the students who have been exposed to it. These benefits were categorised into five sub-themes below.

4.3.7.1 *Social Skills*

Advantages to social skills can be categorised into five secondary subthemes: caring, peer relationships, the ability to work together, social interaction, and patience. These will be set out in turn below. Advantages to social skills can be categorised into five secondary sub-themes: caring, peer relationships, the ability to work together, social interaction, and patience. These will be set out in turn below.

4.3.7.1.1 *Caring*

Two of the practitioners noted that the students have developed a more caring nature in their dealings with one another as a result of PALS. Abeer (Q8) observed that children's social skills have become more evident and that they display much more care towards each other. For example, '… if one of the students missed something at school, her peer would help her out… if a student missed a class then her peer would inform her of the page number in the coursebook and help her search for the right page … I also noticed that they care about each other in the other classes.' Nada (Q8) described the same principle but framed it in a different manner - as a significant decrease in a reluctance to share 'I have some students who used to have an incredible level of egotism … For example, R would always argue that things belong to her alone or if her name was written next to something, no other student would be entitled to it.' Nada continued describing how this pupil would not share any pens, pencils, colours or sheets and did not appreciate pair or group work. Now '… R shares a folder with her classmate H, which is quite an achievement and a pleasant surprise for her mother… It is also so pleasing for me to hear her say that she lets H borrow her pen.' In addition to this, Nada (Q9) pointed out that students have become increasingly adept at dealing with their peers and providing them with encouragement whilst they are playing the role of the teacher.

4.3.7.1.2 *Peer Relationships*

In addition to caring more about each other, evidence would suggest that peer relationships in general have improved. Abeer (Q8) stated that two of her students always seem to argue and not to get along prior to the introduction of the programme; having introduced PALS, 'they became less argumentative and the ill feelings disappeared… I started using PALS as an incentive by telling students they will be allowed to work on PALS if they do not argue.' Amal (Q6) noticed that there had been fewer arguments since the introduction of the PALS programme and that

students were generally friendlier towards each other. She also reported the experience of one of her students: initially, none of her peers had made her feel welcome when they were working in groups or made the effort to play with her during break time, leaving her feeling isolated and unaccepted. However, '… the introduction of PALS brought about a positive development because I could see a change in the relationship with the children finally interacting and playing with their new classmate'. The practitioner noticed a different attitude towards her, resulting in her being the keenest person in the whole class with regard to the programme. In Amal 's opinion, the students' enthusiasm for this method of working was because it revolved around pair work – 'In fact, during the sessions there developed a positive relationship between all paired students who were trying their best to collect the maximum number of smiley faces to compete with the other paired groups.'

Noura (Q4) related a similar story with regard to ~~a~~ student A, who had not been welcomed by the others in the group on her arrival; 'But once the program kicked in and they started working together, they soon became close friends and respectful towards each other… PALS made them spend more time playing together and getting to know each other.' She also commented that there were noticeable improvements in interactive relationships as a result of the PALS programme, citing student S as an example of this; she is the oldest student in her class and tended to avoid the others in the group by sitting alone, but she no longer does this and now happily chats to everyone. The practitioner felt that this change of attitude was the result of having enjoyed herself when working with another person as part of the programme, leading to improved relationships with everyone in the group (Noura, Q8). Nada (Q1) highlighted the fact that the new roles that had been taken by each of the pupils had enabled them to listen to each other and develop a sense of mutual trust. This aided them to become closer and more respectful and considerate towards each other (Q5a), encouraging them to accept advice from each other, thus bringing them closer together. This practitioner also commented that 'It is quite noticeable how they have started to accept one another and recognise their differences… and accept differences' (Q8).

4.3.7.1.3 *Ability to Work Together*

Through working with another person in a pair, children learn the skills required in working together with others. Abeer (Q13) observed a greater ability in her students to concentrate and not become distracted, whilst the system helped her in her

organisation of the classroom. Afnan (Q5) credits Maths PALS with showing her students techniques which enabled them to interact and work in small groups, stating that working in this way became easier and developed their social skills: 'for example, the student now respects her classmate's role and waits for her to develop the idea and reflect on the answer before engaging in the conversation… They do not interrupt each other while talking.' Dealing politely with others was also mentioned by Amal (Q4), whilst Nada (Q1) highlighted increased motivation in students to collaborate with one another as a result of being exposed to this new teaching and learning technique. She also related the example of student R (see 4.3.7.1.1 above) and commented about noticing drastic differences in the behaviour of some students which had a marked effect not only on their Maths but also on their social skills (Q8, 13).

4.3.7.1.4 *Social Interaction*

Clearly, this approach towards working in mathematics classes encourages social interaction. Abeer (Q4) commented that PALS 'urges these students to interact with each other … it creates an environment of interaction and dialogue among them.' Afnan (Q4) recognises the fact that the structured format of working contained within this system '… encourages and supports interaction which is a skill that is often absent in the SEN students.' This practitioner also observed increased levels of interaction, particularly discussions with regard to number (Q5). She also commented that this method 'showed them how to interact and work in small groups', helping them to develop their social skills. Amal (Q4) stated that the programme is useful for encouraging students to engage with each other in discussion as a result of its structure. Noura (Q5) also noticed increased levels of social interaction, a point which was also picked up by the school principal and some of the teachers who visited one of the PALS sessions in which the children were engaged.

Nada (Q5a) noticed that the members of her group became better communicators having been exposed to the PALS system and were much less reticent in speaking with other people as a result of their experiences. She cited the case of student M (Q8), whom she described as very quiet, with a voice that could hardly be heard when she spoke: however, having been introduced to the programme, she became a different person with her partner (A) as they engaged with the paired work. 'She seemed very lively with me as well and I could tell from the tone in her voice… The first time I heard her voice was when she was reinforcing her colleague A using

smiley faces… I told her she was very inspirational, and she laughed loud and covered her face by her hand.' Nada stated that this was the first time that she had heard M laugh and that she was known for not showing her emotions. It became obvious to her that she was gradually forming a relationship with A and that she had achieved something significant, in spite of not interacting with everyone in the classroom. Nada also commented that the programme '…has had a direct impact on their personalities and on their behaviour in the classroom… helped to develop their social skills when dealing with each other.'

4.3.7.1.5 Patience

There has been a marked improvement in student's ability to be patient whilst working with each other. 'One of the students used to get very angry if her peer could not find the answer, but her behaviour changed with time and she learned how to be patient' (Afnan, Q8). In addition, Afnan mentioned that the whole process has been advantageous for this student, in that she is spending more time in explaining things to her partner rather than losing her temper. This point was also highlighted by Amal (Q4) who stated that she has observed students being patient, particularly when the person they are tutoring provides an incorrect answer, necessitating their waiting for a few seconds to allow them time to work out the correct answer, rather than rushing in to give them an answer. Noura(Q8) observed that students are now better at providing clues to their partners in order to work out answers, demonstrating far more patience than before, with one pupil (H) developing into '… an excellent young teacher.'

4.3.7.2 *Academic Skills*

Each of the participants noticed that the system had an impact upon the children's academic skills. Abeer (Q8) found that the performance of the lowest performing students improved a great deal noting that through assuming the role of the teacher, students enhanced their ability to perform the same skill. 'For example, N always made mistakes when pointing to numbers with her fingers, but when she started doing the teacher's role for a number of times, I noticed that she became more accurate and used her fingers correctly when asked by R… This way, information could be instilled a lot more effectively.' Afnan (Q5) observed that the PALS system not only improved the students' academic outcomes in mathematics but she also '... noticed they have become better learners and improved their addition and

subtraction knowledge.' In addition, she noticed that the children have developed the ability to use counting tools, such as sticks, cubes and clothespins, as well as the ability to explain things to each other. She also noted (Q8) that '… one of the pupils did not know how to use her fingers to count, but she is now very good in adding figures… For example, one of her peers used to hold her hand and show her how to use her fingers to add… In the past, she could not do it.' Afnan (Q8) gave a further example of student N, who taught one of her peers how to count and to add – 'She would ask her to stop after counting the first set and do the same thing again after the second set… Afterwards, she would ask her about the total sum by using the equals sign… Then, they both count the overall number together.'

Amal (Q6) recalled being shocked that some of the students did not know how to use their fingers to count prior to engaging with the PALS programme. During the course of the programme it became apparent that the students had become proficient in counting with one being ecstatic, telling them that '… she achieved tremendous progress through the finger counting technique… It really helped them a lot in terms of improving their mathematics level.' She gave a further example with regard to improvements in mathematics; the children started reading larger numbers and distinguishing between the largest and the smallest numbers – 'Prior to the programme introduction, this used to be an area where they made mistakes… But now they have improved so much and developed better knowledge of addition and counting in general… This has had a directly positive and clear impact, in terms of increasing their self-confidence' (Amal, Q8).

In addition to improvement in mathematics skills, children were also observed to be better organised and better able to concentrate (Noura, Q8), with these improvements being explained by children's exposure to '… the various drills and activities which come with the programme' (Nada, Q8). Noura (Q8) talked about A and H, who had not only become more adept in terms of their Maths skills, but also at delivering information in an appropriate manner, as well as developing their levels of patience.

4.3.7.3 *Positive Attendance and Attitude to Learning*

Another positive impact has been recorded with regard to attendance and attitude to learning. Abeer (Q8) related the case of student S, who had an issue with her attendance, although she was clever. The participant reported that she is the quietest

of all the students, which appeared to make her keep a distance from her noisier peers. 'When we started PALS, the school psychologist and I noticed that her attendance improved drastically… She was always keen to know about the following PALS sessions, and whenever we had one planned. I could see that she was very pleased.' Abeer also noted that on visiting the PALS session, the psychologist was interested to know when the system would be rolled out across the school as she was so impressed by it. The attendance record was noticed by S's mother. The psychologist informed her that her daughter's attendance record had improved because she liked the PALS system. This student's reaction to the programme is the most notable of all the students. This increased level of interest was also observed by Nada (Q8), who talked about three students who appear to be more engaged and more willing to concentrate on the tasks set with PALS, which was not previously the case.

4.3.7.4 *Ability to Interact With and Tutor Each Other*

All of the participants provided evidence which indicated pupils' improvement in their ability to interact with and to tutor each other as a result of exposure to this method of teaching and learning. Abeer (Q4, Q6) reported that students feel they have a role to play through explaining things to each other and providing assistance, feedback and reinforcement for each other through adopting the correct procedures, leaving the practitioner to simply supervise their efforts. Afnan (Q6, Q8) observed that the best thing about the programme for them was the fact that students explain concepts to their peers and that seeing children turn into good junior tutors lifted their spirits, which they felt was '… an achievement for all of us.' Amal (Q4) felt that PALS helped the students to develop new skills, such as explaining concepts which allowed them to gain a better understanding of mathematical ideas as a result of being able to explain them properly. In addition, she felt that '… they could act as a proper teacher… They enjoyed very much being able to do what the teacher does on a daily basis, as well as asking and reinforcing each other as tutor and tutee' (Q6). As a result of delivering this PALS programme, Noura (Q5) realised the extent of SEN children's capabilities and how happy they were when they were provided with the opportunity to tutor one of their classmates. She talked of the improvements seen in A and H (see 4.3.7.2 above), particularly H in regard to her teaching skills (Q8).

Nada (Q1) expressed the opinion that the PALS approach allowed students to collaborate with each other and become more accepting of difference. In addition,

she provided examples of how pupils found ways to tutor their peers; ‘For example, H mentioned that R was not able to understand through verbal explanation… As a result, H will use her fingers to do the mathematics… As for A, she would help R by placing her finger on the numbers and ask her to start counting’ (Q8). They also appear to have an ability to decide which methods were best suited for their peers. For example, ‘L also had a problem with R who would not focus much in class, so she would help her by counting cubes and repeating the process over and over again’ (Q8). Nada (Q9) stated that this system gave individuals the chance to actively engage in tutoring their peers and introduce them to a different way of learning, allowing their character to dictate their methods, or basing their methods on the tutee’s preferred learning style. This practitioner provides further examples of this; ‘A is very affectionate and gentle in dealing with M… Whenever they are both working together on PALS, A would help M write down the number… If M stopped, A would tell her nicely to do it again and empathise with her… As for A2, she focuses on passion and zeal… Her partner R, for example, supports Al-Hilal football club… So A2 would tell her to try again and do it slowly and surely until she could get it right and as soon as she received a smiley face, A2 would colour it similar to her team’s colour, which is blue… It really is a beautiful and creative thing to see in class’ (Q9).

4.3.7.5 *Self-Confidence*

It is unsurprising, given the evidence with regard to improved student outcomes, that levels of self-confidence have risen in the children exposed to the PALS programme. ‘I feel that it helped them develop their social skills and increase their self-confidence… For example, when one of my students assumes the teacher’s role, I can see emotional change in tone of her voice and a feeling of joy… This can have a major positive impact on her as a leader’ (Abeer, Q8). Afnan (Q8) observed increased levels of self-esteem as a result of engaging with the programme – ‘I have a student who used to be very shy but has come out of her shell and seemed to interact more with her peers.’ Amal (Q4) commented that ‘PALS is also distinctive as it raises weaker students’ level of self-confidence’, whilst Noura (Q13) stated that ‘PALS helped raise their levels in the numerous E skills and enhanced their self-confidence…'. Nada(Q5a) stated that high levels of self-confidence are ‘… the fruit of pair work and collaboration… The students learned not to feel embarrassed or shy when they speak, and even when they make a mistake, it is no longer something to be embarrassed about… On the contrary, they keep trying and make mistakes until

they finally learn.' She also stated that 'this is a tremendous achievement for them' (Q5a).

4.3.8 When PALS can be used

The overriding feeling of each of the participants is that the PALS system is one which should be used as a complementary or supplementary tool in the teaching of Maths to children. Abeer (Q 1) was of the opinion that these activities should not be utilised in order to teach new concepts in Maths, but that they should be taken advantage of once a full explanation has been given as practice or revision of specific concepts. Amal (Q3) stated that 'it is definitely supplementary to the process of teaching… It is more like an application through which students get to practice what they have learned from the teacher'. Nada (Q 3) noted that PALS complements an educational process which '… does not eliminate the role of the teacher who already has an instrumental part in the explanation of the lesson and in the use of a variety of methods to convey meanings and explain concepts,' with PALS being viewed as a supplement allowing students to address gaps and differences in understanding through helping each other.

4.3.9 Future use

General comments were made with regard to using this programme in the future. Abeer (Q13) stated that it was clear and straightforward to follow whilst Afnan (Q13) intimated that if she becomes a teacher in the future she will apply it as 'it is more beneficial for them [the pupils] academically and socially than individual sessions involving only the teacher and student.' Amal(Q13) commented that it was motivational and fun for students (endorsed by Abeer, Q13, Amal, Q13), and that 'it is a routine changer for teachers who are used to spoon feeding technique', thus encouraging a more positive atmosphere in the classroom. In addition, it was felt that this approach helped with classroom organisation (Abeer, Q13) and that it had a beneficial impact on students, both academically and socially (Afnan, Q13, Noura, Q13, Nada, Q13).

4.3.9.1 *Sharing their Experiences with Colleagues*

Afnan(Q15) stated that she planned to speak to her other colleagues at university about her experiences in learning about and using this approach towards teaching and learning. She also intends to provide training and further assistance to those who were interested in applying this approach in their classroom.

4.3.9.2 *Plans to Apply this Approach Officially in the Classroom*

Once this technique was witnessed by a classroom teacher who attended a PALS class, '… she was so keen that she asked me if she could have the tools, activities and the manual, and had so many questions about the programme because she wanted to start applying it officially in the classroom' (Amal, Q14).

4.3.9.3 *Benefits from PALS in Other Subject Areas*

Benefits from PALS in other subject areas were also noticed by a number of the participants. Afnan (Q8) noticed that there were benefits from utilising the programme in their Reading and Quran classes. Noura (Q4) commented that she utilised paired activities in reading - the more able students assumed the tutor role, while the other took the role of tutee who spelt the words and '… read sentences to the tutor who had to submit feedback and correction procedures if needed… I felt that if this strategy was going to be applied in reading, it would leave a very good impact and become a very effective method.'

4.3.9.4 *Peer Tutoring Course could be Taught at University*

Afnan (Q15) and Amal (Q11) commented that they would like to see the subject of peer tutoring included from a philosophical and theoretical point of view as a part of a course on teaching methods at university; it was their belief that it had been useful to apply this method of teaching practically, having never been aware previously of its existence. In addition, Nada (Q11) found the lecture about the theories and viewpoints regarding peer tutoring valuable and they expressed their wish that '… we could expand on it through a proper module in the teaching methods curriculum at the university… It is a pity that we were not informed about the strategies… So, I hope it would be added to the curriculum for students to take advantage of before graduation.'

4.3.9.5 *Plan to Apply PALS when Becoming a Teacher*

Four of the five participants stated that they would make use of this approach once they became teachers. Abeer (Q8) mentioned that she was actually the first to have applied this approach with her students in her country – 'Hopefully, once I become a teacher, I will put it into practice… It will not be confined to mathematics, but also to other subjects', citing its use when reading the Quran. Afnan (Q13, 14) stated 'I will

definitely apply it if I ever become a teacher because I think it is very useful for the students' and, in spite of its initial difficulties, having seen its impact on the students, I am extremely keen and plan to apply it in the future. Nada (Q13) assured that she will apply Maths PALS as soon as she officially becomes a teacher, in view of the fact that 'it made me really feel I could succeed as a teacher when I noticed the drastic differences in the behaviour of many students, especially in the mathematics and social skills.'

4.3.10 Summary

This section has identified the themes which have emerged as a result of the interview process. Aside from the *Potential Challenges* theme, the overall impression of the impact of the Maths PALS system is very positive. The experiences of the participants, with regard to both the training course and the application phase, illustrate that the content has been valuable and enabled them to be successful in their application of the programme. This can be seen in their willingness to share the information with other colleagues and their enthusiasm for including it as a part of the teacher training process at university. The data clearly outlines the role of the participant practitioners and the positive impact that it has had on their dealings with SEN students in their mathematics classes. It has also shown that they need to reflect upon their wider attitudes towards SEN students in the sense that it has identified, particularly for one person, that the pupils do have tremendous ability. Participant comments indicate their belief that there is no conflict between PALS and other teaching methods and that the programme has many positive benefits, including children being more engaged on task, being better behaved and more motivated in their work. It is a tool which encourages them to develop their ability to work independently whilst fostering a cheerful, fun filled attitude in the classroom. Each of the participants is also full of admiration for the materials that have been produced for use with the children.

The programme was perceived as not only having a positive impact on pupils' attainment in mathematics as a result of engaging with the programme, but children have been seen to be more caring in their relationship with their peers, have developed the ability to work together through increased social interaction and continue to develop their social skills, such as patience. Since its implementation, student levels of attendance and attitude towards learning have also improved as has their level of self-confidence. The data also provide positive indications that set

routines also help SEN students to make progress, not only academically but also emotionally and socially.

5 Chapter Five: Discussion and conclusions

5.1 Introduction

This chapter relates the findings in chapter Four back to the broad literature review in chapter two, showing where the results and preliminary analysis relate to what is already known about peer-tutoring and PALS. These initial findings are summarised below according to each research question, following Biesta's (2012, p.149) "Quan → Qual" structure of mixed-methods analysis in which the quantitative data is analysed first but all data sources are given equal importance through iterative discussion. Results from the quantitative data collection tools are therefore discussed first according to research questions 1 through 4, then summarised in sub-section 5.6. This summary then forms a foundation for discussion of the qualitative data, primarily as it concerns research question 5, in sub-section 5.7.

As well as considering links to the literature review throughout, sub-sections 5.8 through to 5.17 make more specific links back to the relevant literature and discuss how the findings relate to this existing body of knowledge. Given that the existing literature is highly Western-centric, these sub-sections are important for considering how this study contributes to the existing literature. Sub-section 5.18 considers this in much greater detail by seeing how this study fits into an explanatory framework which links theory and context to discuss how the findings are best interpreted. This sub-section also updates the study by drawing upon new work published after the initial literature review, helping to show how this study relates to the very latest thought in peer-learning. More specifically, it is shown that, even with this update, there are still gaps in the literature which this study can help to address. These are detailed more explicitly in sub-section 5.19, pointing out contributions not just to the literature on peer-tutoring, peer learning and PALS but also to the literature on educational change management and the mathematics assessment design literature as relates to a Middle Eastern context.

Having established contributions to knowledge, the chapter then outlines implications of this study for practitioners in related contexts. This includes specific contributions of translated data collection tools, making a unique contribution of translated materials which have been rigorously evaluated so that teachers in Saudi Arabia can – for the first time – have the tools to see for themselves how their students compare on international measures of mathematics attainment and attitudes to mathematics.

More generally, remembering that this study was looking not just at student learning but also teacher education, implications for established teachers, new teachers, and teacher educators are offered in sub-section 5.20. Implications for educational researchers and university-based academics are considered separately in 5.22, where recommendations for future research are made based on an evaluation of the study in sub-section 5.21.

One of the great challenges of mixed-methods design is drawing together all the data sources and analysis approaches and considering what they add to understanding that could not have been achieved simply by using the existing literature. Plowright (2011, p.185) refers to this as the "warranted assertability" of a study, essentially a measure of how convincing the findings and discussion are compared with what might have been predicted before the study was conducted. This provides a helpful opportunity to recap on each research question individually in sub-section 5.23 before drawing all the strands of argument together into final comments in 5.24.

5.2 RQ1: What gains in knowledge are evident from the trainee teachers of SEN children who have undertaken a preparatory peer tutoring course?

This research question was primarily addressed through a 38-item test used to check trainee knowledge. While it was noted that there was no formal training in peer tutoring as part of their teacher education programme, participants were able to do fairly well on this test with a mean score of 46% on their first attempt before receiving any training in how to use PALS. This may be explained by general constructivist principles being a part of the teacher training provision, enabling the trainees to work out reasonable answers. However, the post-test results show that their knowledge could be substantially improved through the additional preparatory course. Every trainee improved their score substantially, moving the mean score for all 5 trainees from 46% to 81%. It was also noteworthy that Abeer, the lowest scorer in test 1 (before the training), became the highest scorer in test 2 (after the training). This offers some indication that the training is effective even for those without much prior knowledge of peer tutoring. Clearly the sample size here is very small, so more participants would be needed to demonstrate statistical significance, but the size and consistency of improvement gives a very strong indication that the intervention is effective in improving knowledge of peer tutoring as measured by the Questionnaire

of Knowledge of Peer Tutoring. Reliability and validity of the tool was found to be good, with full details given below in sub-section 5.21, supporting the claim that the test gives a good measure of trainee knowledge and so any improvements can be used to infer knowledge gains.

The level of performance on the second test suggests that the trainees still had some way to go before being ready to train their students in using PALS. However, it would not have been desirable to have a test which was too easy, so while higher scores may have suggested that the training was more effective, it was equally important that the test was able to discriminate effectively. The results similarly indicate that learning how to use peer-tutoring requires investment in teacher training in order to be effective, supporting the argument that training needs to be both comprehensive and reinforced gradually over time rather than being front-loaded (Topping, Buchs, Duran, & Van Keer, 2017).

Trainee teacher knowledge gains can also be inferred from looking at the fidelity of their PALS implementation. Their overall mean score of 81% is very similar to the fidelity scores for trainee teachers found in a similarly small-scale study of PALS implementation (Mallette, Maheady, & Harper, 1999) and match with the initial fidelity observations in this study (see also 5.3, below). Taken together, this indicates that the trainees sufficiently retained knowledge from their training to be able to take it forward into practice. The improvements in fidelity over time found in this study were also echoed in Mallette, Maheady and Harper's (1999) work. This suggests that knowledge gains are reinforced over time through using PALS materials, so trainees are able to improve their own knowledge after receiving formal training. That these results were shown in another study which did not use trainee teachers supports this interpretation over the alternative, which is that fidelity was lower while trainees were establishing themselves in the classroom.

Overall, the findings strongly suggest that trainee teacher knowledge can be substantially and efficiently improved by dedicated training in PALS prior to leading an intervention. Improvements may be possible regardless of trainees' prior knowledge, although it still seems reasonable to assume that some pedagogical knowledge is useful as a foundation. Similarly, trainees were still not fully knowledgeable following the intervention so there may be scope for future enhancements. It also appears that teachers are able to improve their knowledge

over time through using the PALS materials, suggesting that ongoing professional training and development needs may be able to be met through self-study.

5.3 RQ2: To what extent do trainee teachers of SEN children implement peer tutoring programmes (Maths PALS) according to expected guidelines in the teaching practice?

The validity of inferences made for each of the other research questions relies upon the intervention actually doing what was intended. Without this, the study is only able to compare the effectiveness of two groups of trainee teachers and says little about PALS. It was therefore vital that rigorous checks established the fidelity of Maths PALS implementation for the intervention group. As noted in the methodology, the observation checklist was refined to a high level of inter-observer reliability. Duplication of observations by different raters also established consistency of judgements through moderation, while regular spacing of observations ensured that implementation was consistent across the intervention. This last point was particularly important given that trainee teachers might be expected to change their practices as they hone their teaching skills. Likewise, it has been shown that teachers can misunderstand the underlying principles of a pedagogical approach with the result that they are not really doing what they think they are doing (Vaughn, Hughes, Schumm, & Klingner, 1998). This would bring into question the validity of teachers self-reporting their fidelity to the PALS implementation. Indeed, a later study by the same team confirmed that teachers in special education classrooms were at particular risk of making changes which failed to keep “the critical features of the approach intact” (Klingner, Vaughn, Tejero Hughes, & Arguelles, 1999, p.272). It was therefore appropriate to use an observation schedule and using other observers rather than the teachers themselves.

Fidelity was found to be high from the start and soon increased, presumably as teachers and students became familiar with the new approach. A slight dip after session three might be explained by the teacher and students adjusting to Maths PALS and starting to integrate it with their own teaching and learning preferences. Nevertheless, teacher fidelity remained high throughout and returned to 100% for the final three observations. Similarly encouraging results were shown for student fidelity, with indications that students needed a little time to become familiar with the new approach but then soon became comfortable as fidelity grew steadily to 100%.

Overall, the observation data shows that Maths PALS uptake was effective and remained consistent with the principles used in the training course. Both teachers and students showed complete adherence to the practices of PALS towards the end of the intervention, suggesting that the technique was effectively embedded as a routine in their learning and teaching approaches. These results also underpin the validity of the analysis for the other research questions, and gives an early indication of transferability to other settings in which similar levels of fidelity are achieved.

These results compare favourably to similar studies of fidelity which showed 86.9% fidelity, albeit with a much larger sample of around 200 teachers and over a longer time-span of 18 months (Tymms et al., 2011). Nevertheless, the results of this study add support to the view that teachers can be efficiently trained in how to facilitate PALS and that they go on to implement the strategy with a high level of fidelity. Moreover, this success holds for trainee teachers as well as more experienced teachers. The results of this study also compare favourably to a similar small-scale study of PALS implementation by trainee teachers (this time taking on a tutor role) which saw fidelity range from 56% to 92%, with a mean of 76% across multiple observations of three dyads (Mallette et al., 1999). Overall, the fidelity ratings in this study offer support for the view that trainee teachers perform well when asked to implement new collaborative approaches (Ruys, Van Keer, & Aelterman, 2011). Context may also be highly relevant here, with trainee teachers arguably showing greater fidelity of implementation than experienced teachers since they are less likely to be resistant to pedagogical change and have a smaller repertoire of alternative techniques to draw upon (Stein et al., 2008). Fidelity also shows that concerns about the difficulty of pedagogical change in Saudi Arabia (Alnahdi, 2014) might be less relevant for trainee teachers, or even tentatively indicate that the efforts of Vision 2030 (Kingdom of Saudi Arabia Ministry of Education, 2017) are starting to have an impact on how students are expecting to learn.

5.4 RQ3: To what extent does engaging in the peer tutoring programme (Maths PALS) result in improvements in mathematics for pupils with intellectual disabilities?

The WRAT 4 raw scores highlighted a problem that the two groups being compared were different in terms of their age and attainment make-up, with the intervention group having lower scores on average than the no-PALS group. While teachers had

been randomly assigned to either PALS or no-PALS through giving training to one group of trainee teachers and not the other, the trainee teachers were assigned to existing classes and so students were not randomly re-allocated but rather remained in groups which were not created with randomisation or the needs of this study in mind. This made direct comparisons problematic as the classes belonging to teachers randomly assigned to PALS were more proficient in mathematics and older than students in the control group. Nevertheless, using a three-month gap still enabled progress within groups to be assessed, so while caution would be needed in interpreting the raw scores in each test there could still be an evaluation of improvement both in terms of additional points scored and improvements in score as a percentage of the score achieved before the intervention.

In contrast to the argument that more able students will tend to make faster progress, it is equally arguable that some of this percentage gain effect may be because the control group had greater scope to improve and that the new teacher had the benefit of more 'low hanging fruit' when teaching the group. Nevertheless, it neatly illustrates that real-world interventions can be problematic at this scale since the groups are not readily comparable and the choice of statistical test can have a dramatic impact on interpretation. This problem could have been extremely damaging to the study if not for the ability to pair samples (i.e. to know the pre-test and post-test scores of each individual student in each group). This allowed more sophisticated analysis and controlling for other variables, making comparisons between the groups much more nuanced and sensitive. From this enhanced analysis, age was found as a potential explanation for differences between the groups.

More specifically, an individual student's age could range from 7-15 years within these multi-age classes. ANCOVA analysis recommended a correction to group means to take account of the impact of age. These estimated marginal means are summarised in the findings chapter sub-section 4.2.3.

Special education settings offer some insight here since the age range within a class can vary substantially. In this study, for example, the mean age was 11 but ranged from 7 to 15. This means that the class effectively covers an age range which would typically span different stages of education, with around 40% of students who would typically be in the primary stage and the remaining 60% who would be in the secondary stage. This situation is much more common in Saudi Arabia than Western countries, in part due to the much higher rate of special education provision in Saudi

Arabia than Western countries, Saudi Arabia identifies twice as many for special provision as in Western countries (Al-mousa, 2010). The importance of using age-adjusted figures resulting from ANCOVA will be of particular value to other researchers working in similar settings, since other studies of PALS have not had to contend with such a wide range of ages in the same class. Without controlling for age, however, the impact of PALS on performance in this study might have been overlooked and it is therefore crucial that future research keeps this additional statistical requirement in mind.

It is therefore arguable that, when controlling for age effects, the PALS group made more progress, both in absolute terms and in percentage terms, when compared with the control group. This limits comparability to other studies, but falls within the broad range of reported effect sizes in a systematic review of peer-mediated learning strategies (Kunsch, Jitendra, & Sood, 2007). The literature would suggest that the true effect size for this study would be a small positive effect in keeping with similar studies involving students with special educational needs within non-mainstreamed classrooms which typically report a lower effect size than studies in mixed classrooms or with a majority of mainstream students (Kunsch et al., 2007), thereby supporting interpretation based on the age-adjusted figures. However, it might simply be the case that PALS has very little effect in terms of performance on mathematics tests, as observed in Gorard, See and Morris (2016). It is therefore possible to make a case for this study supporting various interpretations in the existing literature. Overall, it seems prudent to conclude that the impact of PALS on performance was positive in terms of progress, and may be substantial when age is removed as a factor, but may also have a broadly similar impact as that of traditional teaching approaches.

5.5 RQ4: To what extent does engaging in the peer tutoring programme (Maths PALS) result in positive changes in attitude in pupils who have intellectual disabilities towards mathematics?

While only some of the analyses support the claim that Maths PALS was able to improve performance any more than normal teaching practices, and indeed might even be argued to be slightly less effective, there was clear evidence that enjoyment of mathematics was substantially enhanced through Maths PALS. Compared with a virtually static level of enjoyment in the control group after 3 months (in itself a

pleasing result for a new, novice teacher who might be concerned about being less effective than the regular class teacher), attitudes substantially improved among the PALS group. Not only did the mean rating increase by 8.15 points, a 34% gain, but the reduction in standard deviation also suggests that the group as a whole became more consistent in its increased enjoyment of mathematics.

Similar conclusions can be drawn from the post-ANCOVA age-adjusted figures for both groups. Overall, these results strongly suggest that the main benefit of PALS could be in student attitudes, and that benefits may apply to the whole class rather as well as for particular individuals. This is reassuring as it might have been assumed that only the most outgoing or social students would prefer PALS, as suggested by analysis which shows that confident students make much faster progress in PALS than shy students (Druyor, 2012) or that student preferences for traditional pedagogy would be difficult to challenge, as in Kinchin's study (Kinchin, 2004). However, this appears to not be the case.

The results of this study also show much stronger improvements in student attitudes than in the current research literature, with a systematic review showing only mild to moderate effects on pro-social behaviour (Ginsburg-Block, Rohrbeck, & Fantuzzo, 2006). Context may be especially relevant here, with strong international criticism of poor student engagement in Saudi Arabia (Springsteen, 2014) suggesting that these students were not enjoying their learning and needed something new. Nevertheless, it is encouraging that PALS appears able to deliver this boost in enjoyment in an environment where enjoyment has previously not been a priority.

5.6 Summary of research questions 1-4

Observation data showed that both teachers and students adhered closely to the principles and practices of Maths PALS, indicating that the approach was found to be suitable over the 12-week period. The observation data also confirms that the intervention was sufficiently distinct from standard pedagogy to be able to designate a control and intervention group, although these observations could have been more robust. Unfortunately, random sampling of teachers did not result in sufficient randomness in the sample of students, with a skew towards higher-attaining students in the intervention group (i.e. those receiving Maths PALS). Controlling for age helped to show that differences in the groups related to the intervention were still statistically significant. However, depending on how differences are controlled for, a

range of interpretations are possible regarding attainment and so it cannot be entirely argued from this data that Maths PALS was any more effective than standard teaching in terms of mathematics performance.

It is much clearer, however, that Maths PALS was associated with a substantial improvement in students' attitudes towards mathematics. While both groups started with very similar attitudes, the Maths PALS group ended the intervention much happier with mathematics than the control group, whose attitudes were largely unchanged. There is also some indication that the Maths PALS group took on a closer group identity based around shared and improved attitudes to mathematics. The following sub-section now discusses how these findings relate to discussion during interviews with the trainee teachers, drawing together these findings with this qualitative interpretation.

5.7 RQ5: What perception do trainee teachers have of the peer tutoring programme (Maths PALS), its implementation and the outcomes for pupils and themselves?

Answering research questions 1-4 addressed the initial desire to quantify the impact of the Maths PALS intervention and ensuring that the intervention was being implemented as intended. Using these measures, it has been shown that trainee teachers can be easily trained in the intervention pedagogy, that they and their students can adhere to the principles and practices of PALS, and that attitudes to mathematics substantially improve when compared with traditional pedagogy. It was also shown that performance on a mathematics test showed improvement, but it was not clear how this compared with performance gains resulting from traditional pedagogy.

For those practitioners looking to improve student attitudes, this may be reassurance enough that progress is made since improved attitudes may lead to better engagement and therefore more progress in the longer-term. However, teachers concerned only with improvements in test performance might be tempted to keep using traditional approaches even if they are less enjoyable for students. For example, a study in Africa identified teachers' persistent traditional beliefs as a key barrier to pedagogical innovation in general and peer-tutoring in particular (Abosi, 2007). Similar concerns have been raised about innovation in ICT-based innovation

in Saudi Arabia (Oyaid, 2009), suggesting that such attitudes might reasonably be expected in a Saudi Arabian context.

Oyaid's (2009) study highlights two key aspects of the problem, first suggesting that the assessment system in Saudi Arabia is too restrictive and therefore forces teachers to adopt short-term approaches and, second, pointing out that the majority of teachers genuinely believe that the old ways are the best. If peer-tutoring is unable to show improved test performance in simple comparisons of mean (i.e. without the need for age adjustments), this might serve to reinforce unhelpful beliefs that drilling is the best approach for student learning. Performance gains were evaluated in this study using a modified version of the internationally-respected WRAT-4 maths subtest, so it might be the case that performance gains would be worse using the narrower tests in common usage in Saudi Arabia. While it is arguable that the tests need to be improved to have greater validity (i.e. assessing mathematics skills rather than memorisation), it is also a teacher's duty to help their students do as well as possible on high-stakes tests which – at least in Saudi Arabia, where students can be held back a year – can have a significant impact on their education prospects.

Research question 5 helped to look at this issue of judging outcomes in more detail, going beyond the quantification in research questions 1-4 and giving teachers the opportunity to make broader qualitative evaluations of the intervention.

5.7.1 Views of the training provision

The first family of themes concerned trainee teachers' experiences of the PALS training course. While it was encouraging that the trainee teachers expressed enjoyment of the training, it was more important for them to see PALS as a viable teaching approach given the aforementioned concerns (e.g. Alquraini, 2010; Oyaid, 2009). In terms of how they conceptualised PALS in the traditional vs. constructivist discourse, trainees seemed to make a link between the training using creative pedagogy and PALS being a creative approach. This was expressed as a positive and may have influenced why they found the training so enjoyable. Similarly, trainee enjoyment may have related to the greater preparation put into the workshop materials than might usually be the case for training on their university programme.

The added research interest and enthusiasm for a new approach clearly had an impact on preparing engaging materials, with far more time invested by the trainer than on other areas of the teacher training programme. However, this could also be

beneficial if it helped to model for trainees that creative pedagogy often requires more time invested by teachers at the start in order to establish new approaches. One of the criticisms of research into peer-tutoring and similar interventions is that the time taken for staff training or coaching students in new classroom routines is rarely taken into account (Bramlett, Cates, Savina, & Lauinger, 2010), so it is important to acknowledge that training does represent an opportunity cost but one with which the participants were more than satisfied. Likewise, teachers need to be aware that tutor training will require significant time investment if it to be effective, particularly if, as in this study, they are using a form of cross-age class-wide peer tutoring (Barbetta, Miller, Peters, Heron, & Cochran, 1991).

It was also noteworthy that teachers did not just refer to their ability to recall information about PALS or simple procedural knowledge for running the intervention. In contrast with their relatively passive role as learners at university when listening to lectures, this training put the teachers into more active learner roles. This helped them to empathise with what they ask their own students to do and emphasised the value of creating memorable experiences rather than just transmitting knowledge. As discussed in the literature review, effective training must include awareness of goals, feedback and problem solving (Simonsen, Myers, & DeLuca, 2010).

Looking back after the intervention also highlighted how the training helped the trainees to feel more prepared as teachers. This reflective discussion during interviews helped the trainee teachers to understand what had worked and how they might seek to implement PALS or related programmes in the future. It is also evidently important that teachers are supported formatively so they can viably see the benefits throughout the process with regular feedback to ensure ongoing tutoring is heading in the right direction, which helps to explain the improving scores on the semi-structured implementation fidelity observations. PALS also requires constant monitoring from the teacher so that they can set specific tasks for each tutor, so the regular opportunities to discuss the implementation, matched with advice from Goodlad (1999) that supporting teachers with regular feedback is one of the seven golden rules for designing and implementing tutoring schemes.

This focus on ongoing support, training and reflection throughout the intervention also helpfully challenges the idea that novice teachers need to get the basics right before they can try innovative approaches, and gives a helpful illustration to new teachers that student-centred approaches are viable. While there are clearly

enhancements possible given that the trainees were still not scoring full marks on the Knowledge of Peer Tutoring test, the interview responses strongly indicate that trainees would be highly appreciated of some form of peer-tutoring training as part of their teacher education programme.

5.7.2 Views on the role of the teacher

Maths PALS training seemed to help trainees to reconceptualise the role of the teacher and develop a more rounded view of their role, moving from teacher-centred to student-centred principles. Comments emphasised teachers as offering guidance and supervision rather than knowledge. For example, Amal noted that the experience of facilitating the PALS group had helped to change his overall views of teaching away from didactic approaches. This was not previously mentioned in the peer-tutoring literature, and may reflect the dominance of traditional didactic views in Saudi Arabia. If so, this suggests that training in PALS might help to stimulate deeper thought in trainee teachers in Saudi Arabia. For example, similar progression in trainee teachers' thinking was found in the UK by Twiselton (2000), whose study of trainee teachers categorised their approaches to their role as a teacher in three categories: task manager, curriculum deliverer, and concept or skill builder. To help analyse how views may be shifting among this sample of teachers, each of these stages will now be briefly discussed.

Twiselton (2000) used these three categories to better understand how trainee teachers thought of the curriculum, and in particular whether it was seen as an end in itself or if teachers thought about learning beyond the curriculum. For example, some of Twiselton's trainees were observed to focus too much on the specifics of a learning objective rather than why students were doing a particular task. Described as a task manager, such trainees might therefore simply describe how students are finding verbs in a text. In contrast, a curriculum deliverer would explain how students were addressing a particular learning objective (such as learning how actions are described). At the most sophisticated level, a skill builder might emphasise the link between reading and writing, or that recognising the absence of verbs would help students to check their work for incomplete sentences.

The teachers in this study all implemented PALS with a high degree of fidelity, and their interview responses showed that they referred to some of the aims of PALS, particularly when explaining what worked well in the intervention. This would indicate

that the trainees were already moving beyond the task manager perspective. References to students' improved confidence, social skills, or time on task all likewise showed that the teachers were thinking beyond the specific tasks (indeed, the mathematics in tasks was often not mentioned). Comments which suggested teachers moving into the skill builder category were rarer, as might be expected this early in their training, but there were some encouraging comments related to personalising the PALS approach or how students were developing broader problem-solving skills.

It was noted by Twiselton (2000) that the introduction of a more prescriptive primary school curriculum in England and Wales seemed to shift how trainees thought about the curriculum and their role. For example, trainees no longer discussed tasks without mentioning learning objectives, indicating an encouraging reduction in those who saw teaching simply as managing tasks and behaviour. However, there was also a decline in the number of trainees seeing teaching as building concepts or skills. While this intervention was only brief and clearly did not seek to have such a profound impact as the National Numeracy Strategy in England and Wales, it is worth considering that teachers will need to understand the principles behind PALS in order to avoid similar problems of not seeing the broader intentions behind specific outcomes. There are many worthy outcomes associated with PALS, ranging from academic performance through to a range of social skills and affective improvements, so it is important for teachers to remember that these are outcomes in support of a longer-term goal such as developing self-regulated learning skills.

The teachers also seemed to vary in how independently they wanted students to work in their pairs. They appeared to still desire a large amount of control and saw it as important for them to assess students and choose suitable pairings. Some trainees also saw it as vital for them to support those students who were acting as tutors, although this was focused more on reinforcement and encouragement rather than transmission of knowledge. While this was helpful in shifting the focus from teaching to learning, it still indicated that the trainees were uncomfortable giving up control. For example, Noura's description of the teacher's role in PALS being 'massive' suggests that she may have taken on too much direct supervision of pairs rather than stepping back and acting as a resource.

Such overly-specific views of learning outcomes and attitudes to learning may change gradually, and are to be expected from novice teachers, but it is still important

that training can continue to challenge such views and give teachers the confidence to allow students sufficient time and space to work through problems together. It is also worth considering whether training can be front-loaded as in this intervention or if more gradual training would be preferable to help teachers adapt to new pedagogical principles, as is currently recommended in training teachers to lead peer-learning (Topping et al., 2017).

As discussed below in relation to teachers' changing attitudes, their views seemed to shift from traditional didactic pedagogy to a student-centred pedagogy, albeit one which still required significant teacher involvement. Therefore, as well as the training being beneficial to the teacher's attitude, they can also gain valuable space to observe learning and consequently develop a more expert and nuanced understanding of the discipline (Liu & Carless, 2006). For example, Nadeer noted that she was gradually learning when to intervene and when not to intervene, so training to support this kind of judgement might be helpful in encouraging teachers to focus less on what they are doing as teachers and more on what their students are doing as learners.

5.7.3 Views on training students

The semi-structured observation schedule indicated a very high level of fidelity in how both teachers and their students implemented the PALS intervention. This supports findings from a longitudinal research study which found that mathematics teachers continued to implement PALS with a high degree of fidelity even years later, provided that teachers felt supported, in control of their own professional decision-making, and could see their students continuing to make progress (Baker, Gersten, Dimino, & Griffiths, 2004). While these trainee teachers did not have the same degree of autonomy as in the study by Baker and colleagues, the other elements such as quality of resources, professional support and regular monitoring of student performance were all well-established throughout the intervention and may go some way towards explaining how closely trainees kept to the training materials.

The interviews probed in greater depth just how far PALS principles had integrated within the classroom. This revealed much more about the struggle of training students in a new approach, noting that training took longer and required more teacher input than trainees initially expected. This was most evident in encouraging students to take on tutor roles, such as awarding smiley faces. However, it was noted

that students soon became familiar with the approach and became more independent of the teacher. Initial concerns about students' behaviour were also soon allayed, with teachers gradually reducing their input to simply remind students of the processes and aims of PALS. Even within this short intervention, it was noted that pairs developed greater trust so that students were not just increasing their independence from the teacher but were seeing each other as providing support. This seemed to surprise some of the teachers, particularly where more able students were seen to happily take on tutor roles.

While pairs were carefully chosen and assigned by the teacher in each case, this progress could suggest that students might be able to choose their own pairs once the principles of PALS become more established, opening up other peer-learning opportunities in tandem with the more tightly-structured PALS sessions. Evaluation of their own performance also suggested that teachers saw their students developing group work and cooperative learning skills as worthwhile outcomes in their own right, with teachers being justifiably proud of how much progress their students had made.

5.7.4 Changes in teachers' attitudes

With changes noted above in how teachers viewed their own role and how students developed new skills to support their own learning, it follows that changes in pedagogy would potentially develop from the intervention (see also 5.7.5, below). One of the most dramatic changes was described by Nada, who had previously not enjoyed teaching mathimatics but described her perspective as completely changed. Similar feelings were evident from some of the students, with teachers referring to much more enthusiasm in the classroom. As well as increasing teachers' and students' enthusiasm for the subject, the intervention also seemed to improve teachers' attitudes regarding their students. Afnan articulated this well, noting her greater respect for his students' ability to learn. This may be an early sign that Afnan was developing more constructivist views of learning, adopting a growth mindset in seeing greater learning potential in her students.

Even though improvements in mathematical ability might not have materialised, Afnan's raised expectations were representative of all five teachers. This change in attitudes could be of great importance and crucial to PALS moving forward for students with SEN by encouraging greater interest in these students as capable learners. As noted in the literature review, research opportunities in Saudi Arabia

may be restricted around attitudes towards special needs because they are seen more as something to be dealt with privately within families than at school. Therefore, changes such as this one described by Afnan could be the start of a shift in attitudes around helping pupils with SEN within schools and looking into how they can learn more effectively.

5.7.5 Changes in pedagogy

Raised expectations and a growth mindset are important for developing student-centred pedagogy, as highlighted by initial concerns that PALS could be too challenging for students with SEN. Such attitudes could present a significant barrier to change in establishing PALS more widely. However, the findings suggest that this barrier is easily overcome. Amal's description of students getting into the routine of PALS shows how these concerns were soon dispelled once she had engaged students and set up the learning.

Concerns about PALS increasing teachers' workloads or creating new responsibilities similarly failed to materialise. Indeed, teachers soon recognised that PALS reduced the burden on them to constantly engage the attention of the group and, in Abeer's words, "do all the talking". Additionally, an important aspect of PALS is that it is supposed to complement or supplement current curricular activity. This meant that, by using PALs, the teachers were not having to change their curriculum and planning for the rest of the day or week. This meant that PALS was supporting, rather than just replacing, existing classroom routines, with individualised practice reinforcing current skills and new expertise been achieved, especially in developing more independent study habits. Such enhancements to pedagogy could potentially reduce the stress of extra workload in the short and also longer term, giving teachers greater scope to supervise pairs and gain some space and time to reflect on how learning is developing.

Stress and workload also seemed to be reduced by greater student enthusiasm, meaning that teachers spent less time on cajoling students or managing behaviour. Increased enthusiasm from teachers also seemed evident, so it could also be the case that teachers were working just as hard but felt energised by the experience rather than drained. For example, teachers reported spending more time on monitoring and engaging with small groups, which may be less emotionally tiring than whole-class teaching. This is an encouraging finding since it has been argued that

one of the key challenges to effectively sustaining PALS could be teachers persisting with the approach consistently and managing the preparation demands within their workload (Stodden, Galloway, & Stodden, 2003).

Related to workload were concerns about the cultural appropriateness of PALS. Such concerns may be well-founded given the limited research on peer tutoring in contexts similar to Saudi Arabia. However, it was noted by the teachers that the existing training materials were effective and did not require any adaptation. Designing PALS in such a way as to avoiding adding to teacher workload, and ideally to reduce it, has been highlighted as a key goal for educators (Darrow, Gibbs, & Wedel, 2005). It is therefore encouraging that the teachers in this study did not feel the need to significantly adapt the PALS resources or create their own activities. This is especially encouraging given the sample comprised trainee teachers since trainee and new teachers are noted to put a great deal of emphasis on adapting or creating their own resources, significantly increasing their workload as a signifier of their own professionalism (Findlay, 2006).

Indeed, even discussion of adapting PALS for situations where the cultural context of Saudi Arabia would have been more influential than in mathematics seemed to emphasise how little PALS would need to be adapted. Abeer's enthusiasm to try the approach during Quran study serves to highlight how the teachers saw wider potential for PALS even in areas where traditional didactic pedagogy has dominated. This idea of extending PALS closely resembles how Topping describes developments in peer-tutoring more generally (Topping, 2005). For instance, despite its strong links with constructivist approaches to learning, Topping notes that peer tutoring was originally focused on "narrow 'drill and skill' approaches" in reading and mathematics (Topping, 2005, p.639). However, peer-tutoring later branched out both in terms of the subjects where it was used and the skills it sought to support. The major shift came when peer tutoring was used to support thinking skills, bringing the technique to university-level and therefore a vast range of subjects, the extension serving to broaden peer-tutoring in schools and making a valuable contribution to strategies such as philosophy for children (Topping & Trickey, 2007a).

Another reason for the extension of peer-tutoring could also be shifts in the dominant pedagogy. For example, Topping (2005) describes how peer-tutoring has gone from practicing repetitive tasks following direct teacher instruction and moved into more flexible skills development. In a longitudinal follow-up, it was even found that peer-

tutoring was improving dialogue between teachers and students, with classrooms becoming more intellectually stimulating and discursive (Topping & Trickey, 2007b). The teachers' enthusiasm for trying PALS in new subjects might therefore be indicative of their desire for greater dialogue and a more skills-focused classroom as they take on their own teaching groups.

5.8 Challenges to PALS implementation

PALS appeared to encourage more student-centred pedagogy, but there were some concerns that it was too tightly structured to allow for more creative approaches. This was most notable in dialogue, with Noura wanting to give students more freedom in how they choose to approach a task and the resources they draw upon. It may well be that PALS provides a useful gateway for more creative approaches, as in Noura's case where it seems to have inspired her to look into more creative approaches similar to task-based learning.

For teachers like Noura, PALS seemed to be a gateway to considering peer-learning more generally and she seemed drawn to other peer-tutoring and group learning situations which would stimulate more dialogue than the relatively tightly-structured PALS approach. It might therefore be appropriate to consider future training opportunities once teachers have become comfortable with the principles of PALS, helping them to consider more demanding implementations such as task-based learning.

While traditional pedagogical beliefs were not the barrier that was first expected, one apparent practical limitation was the level of teachers' confidence in their subject knowledge. PALS offers a flexible approach and encourages students to try out approaches and seek regular feedback, which could be intimidating for teachers who do not feel prepared to instantly diagnose students' misconceptions or be able to highlight why a particular strategy failed. In contrast with a didactic approach where a teacher can prepare and ensure their knowledge is sound in a very specific area, PALS creates spontaneous opportunities which could be unsettling. However, this flexibility is less broad in PALS than in approaches such as task-based learning, suggesting again that PALS could be a useful introduction to peer-learning for both students and teachers.

There is also a link to changing teacher attitudes so that, perhaps most importantly, teachers should not feel embarrassed if they do not know an answer since they can

be more effective role models by showing how to work around a problem. It may well be the case that this anxiety from teachers is a result of a lingering belief that the teacher should be a ‘sage on the stage’ (King, 1993), when PALS emphasises the alternative ‘guide on the side’ role. Nevertheless, subject knowledge in mathematics is a perennial concern of teachers and PALS could well be less effective when teachers lack subject expertise. As a practical issue, some schools struggle to recruit mathematics teachers and so might be drawn to straightforward didactic approaches which consequently limits the potential for PALS as a school-wide approach. In such situations, the didactic approach might be the preferred option where teachers lack expertise to feel comfortable in more flexible approaches such as PALS. This study offers some evidence that novice teachers, including some who disliked mathematics, were able to use PALS effectively. However, for reasons of sampling, it is unlikely that any study could focus on the pedagogy of teachers with poor subject knowledge so this could be a question which remains to be answered.

Aside from subject knowledge, teachers also acknowledged some barriers related to the special educational needs of their students. These barriers were soon overcome with extra time and effort as teachers returned to their training resources for support, but they nevertheless highlight the necessity of establishing PALS thoroughly from the outset and leaving enough time to properly train students in their new tutor role (Topping et al., 2017). In short studies, this time cost might not be paid back in time to show PALS as any more effective than traditional pedagogy. It is also worth remembering that these were trainee teachers, so the experience of having to spend much more time preparing for lessons at the start of their teaching practice than later is typical and might not necessarily be a feature of PALS any more than for any other pedagogical approach used by novice teachers with a new class.

PALS may also be limited in settings such as this study where class sizes are small. While small class sizes are usually welcomed, it limits the potential for good tutor to tutee matches since the range of student skills available is smaller. This limitation may also be exacerbated by the class comprising only students with special educational needs, meaning that the range of tutee needs which need to be accommodated is broad. Thus, the setting of this study presents a broader range of student needs at the same time as a narrower range of tutor variety. The meta-analysis conducted by Kroesbergen and Van Luit (2003) is particularly illustrative here. From their sample of 58 studies of interventions in mathematics for students

with special educational needs, they found 10 studies in which peer tutoring was a substantial part of the intervention. However, with a mean sample size of 55.5 students, these interventions were clearly utilising larger class sizes and, by extension, a broader range of potential tutors.

Nevertheless, against their conclusion that peer tutoring had only a very small effect in mathematics improvement for students with special educational needs (weighted effect size=.87), some of the most positive results were found in those studies with smaller sample sizes, albeit with the additional caveat that these studies tended to be dated (e.g. Pigott, Fantuzzo and Clement, 1986, with a sample of 12). Clearly, there remains a challenge in reconciling the data coming from meta-analyses and practitioner research with the studies led by peer-tutoring enthusiasts such as Topping and Fuchs. Those looking for advice about how to implement PALS in their particular setting are likely to find a search of the empirical literature rather underwhelming if they focus on effect size, which does not really match the enthusiasm and wide-ranging qualitative benefits promised elsewhere (e.g. Topping et al., 2017). This may also reflect a tension in qualitative vs. quantitative research on this topic, subsequently increasing the need for rich case study research so that teachers looking for advice can judge transferability to their own setting for themselves

5.9 Comparisons between PALS and other pedagogical approaches

PALS encouraged teachers to try more student-centred approaches, with some teachers appearing to take on much more constructivist views. This is useful because of peer tutoring having a long history tracing back to constructivist ideals (Topping et al., 2017). This also meant that these teachers specifically were looking at the improved peer relationships which should be seen as a foundation and are part of the explanation for peer tutoring working effectively. Helping to view PALS through social constructivism also incrementally shifts emphasis away from teacher-centred pedagogy. Discussion around PALS and other approaches developed this point further. Some teachers seemed to think of PALS as a teaching approach, while others thought of it as a teaching strategy. This matches with the description in Topping (2005) where some teachers see PALS as supporting traditional drilling practices, while others see it through an explicitly Vygotskian lens. More recently, however, the shift has been to the latter (Topping et al., 2017) and this also seems true for the teachers in this study.

While the most obvious comparison was between the pedagogy of the intervention and control groups – PALS and traditional approaches – some teachers referred to a broader repertoire. For example, Afnan described how she found PALS more effective than her normal collaborative learning approach. Within this implementation of PALS, learners were in pairs where one student was slightly more advanced than the other. This suggests that working in dyads with a more intensive collaboration between two people may be more beneficial than pedagogies that employ working with larger groups. Additionally, students may gain better understanding of mathematical concepts from somebody who is only slightly more advanced knowledge than themselves rather than the teacher because they are able to explain ideas in a more simplified way to their peers. For example, students in the tutor role may have recently experienced similar mathematical misconceptions so are also able to help peers to understand in a way that helped them.

References to a broader range of strategies also suggests that the two groups might not have been quite so contrasting as originally intended. Keeping in mind that both groups were taught by trainee teachers, the control group might have experienced more constructivist and creative approaches than a typical classroom in Saudi Arabia. For example, Nada gave a list of strategies she used when teaching, including a range of modelling, discussion and cooperative learning activities which would hardly qualify as ‘traditional’ pedagogy. This is addressed more fully in 5.21.2, below, where a potential lack of distinction between the two groups is acknowledged as a limitation, but one which is common to such designs (e.g. Fuchs, Fuchs, Hamlett, Phillips, & Bentz, 1994) and may not be as significant a limitation as it first appears.

More generally, if it is the case that the trainee teachers used in this study are more innovative than the average established teacher, then the contrast between PALS and current pedagogy norms may be even stronger than the differences found in this study (i.e. a true comparison would be against a much more traditional control, where differences would be even greater). This situation also makes transferability difficult to assess. For example, contrasts between PALS taught by a new teacher and traditional pedagogy taught by an established teacher introduces the extra variable of experience. Similarly, retraining an established teacher to use PALS would introduce complexities around retraining and a potential selection bias of the most enthusiastic teachers. While ‘traditional pedagogy’ is used throughout this thesis, it

is therefore important to consider that the strategies used in the control group were likely to be much less traditional than across the school or Saudi Arabia in general.

PALS also opened up teachers to thinking about the benefits of similar approaches, and appeared to reinforce their support for collaborative learning approaches across the curriculum. Benefits were generally described as either giving students more flexibility or requiring less time training students or setting up activities, reducing wasted time in the classroom and stimulating a more purposeful learning climate. Even where teachers continued using some traditional didactic approaches, they found that PALS worked well as a supplementary approach and did not require them to change the foundations of their pedagogy. It is encouraging that PALS was able to shift the views of those who were open to being persuaded, but did not cause conflict for those who were happy with the status quo, thereby suggesting that PALS may be a low-confrontation approach to pedagogical innovation.

5.10 Outcomes from PALS

Teachers discussed a range of outcomes from the intervention, which can be broadly summarised as relating to individual student outcomes or whole-class outcomes.

5.10.1 Individual student outcomes

One of the key challenges of teaching groups of children with SEN is often maintaining focus with short attention spans and PALS seemed to help in this regard, with students spending more time on task without needing prompting by their teacher. There are several possible explanations, such as prompts coming from their partner, the tasks being a more suitable difficulty level, or the tasks themselves being more engaging. Reference to classroom climate also suggested that the classroom itself started to feel more purposeful, which could have helped individuals to focus and reduce distractions from others.

Some teachers also felt that learning to rely on each other, rather than on the teacher, also helped students to appreciate how they could work through problems and help themselves. This helps students to become more independent learners and feel more confident to try themselves first in a variety of subjects and situations within and outside the classroom. Margolis (2005) points out that students experiencing success in curriculum-related tasks can be highly rewarding, so while smiley faces were used as rewards in the PALS sessions, it seems reasonable to assume that

intrinsic motivation will also have developed alongside a growing sense of self-efficacy.

Being able to reflect on a problem and devise strategies is also a key aspect of self-regulated learning (Zimmerman, 1990) related to making better use of peer-, tutor- and self-feedback (Nicol & Macfarlane-Dick, 2006), so it is very encouraging that PALS appears to have given students more strategies. As students advance through the mathematics curriculum, problems which can be solved using a range of strategies should help to reinforce this aspect of problem-solving as students learn that mathematics also involves knowing which thinking tool to select for a particular task rather than just following routines selected by a teacher.

5.10.2 Group student outcomes

Students in the PALS group showed increasing independence not just in academic terms but in normal classroom routines too. Students were found to spend more time on task, possibly because they were not as reliant on a teacher so spent less time passively waiting for assistance and more time helping each other. The PALS routine also seemed to encourage students to simply get on with their work, so routines such as getting out folders or equipment were performed faster. This could also have been influenced by the activities themselves being more engaging, making students keener to get started. Whatever the cause, these individual improvements appeared to be shared among the group and so had a cumulative effect of creating a more purposeful classroom climate.

Enthusiasm and purpose are key aspects of a positive classroom management strategy (Rogers, 2011), so it was to be expected that these improvements in individuals would lead to better classroom management. Rogers (2011) similarly describes how wasted time is often a sign of low engagement or passive misbehaviour which can slowly undermine a teacher's authority, so it is encouraging that Abeer noticed a reduction in set-up which resulted in more time being available for learning. More broadly, teachers noted that other misbehaviour – such as name-calling – also reduced. This may be due to the more purposeful classroom climate and greater engagement with work, or could reflect improved peer relationships through the collaborative learning experience and co-dependence fostered in PALS.

5.11 Explanations for affective benefits

Teachers described a range of positive affective outcomes for students, mainly centred around motivation and enjoyment. This supported the substantial increase in enjoyment reported by students in their attitude questionnaire responses. One direct explanation for this, offered by Noura, was that smiley face rewards provided extrinsic motivation as well as contributing to a more general positive classroom atmosphere where students felt rewarded. The game-like activities were also described in ways which suggested that they brought intrinsic motivation, creating genuinely enjoyable learning experiences. For example, the game board used within PALS provides an engaging approach to displaying mathematical problems which looks more like a game than a standard academic task (Fuchs, Fuchs, Yazdian, & Powell, 2002).

Visible progress was also offered as an explanation for motivation, with the constant feedback from PALS helping students to see themselves as making progress. Even though simple measures of progress overall across the 12 weeks showed improvement no better than in the control group, the incremental nature of PALS gave lots of opportunities to celebrate small successes. Success was also rewarded promptly by peer feedback. This feedback is given instantly which reinforces straight away how well they have done and means they are less likely to forget their achievements than if reminded of this later on. It helps to show pleasure in proof of understanding and provides further motivation to get the answer right. Being able to break the subject down into small victories in this way has been offered as an explanation for the popularity of PALS in mathematics and reading (Fuchs et al., 1994), and this seems to be true in this study too.

Further intrinsic motivation may have come from opportunities to communicate. Afnan, for example, lamented that students with SEN rarely got the opportunity for meaningful interactions with peers in class. Having a sense of purpose, structure, and even having interaction initially made obligatory by the teacher, all contributed to initiating positive interactions. This is a particularly interesting finding since some teachers might be reluctant to use peer tutoring if they are concerned that the interaction would make some students uncomfortable, especially if they have concerns about poor social skills. However, this study seems to suggest that the structure and purposefulness of PALS provides some much-needed scaffolding for positive interactions to develop. One simple change from PALS was in the physical

use of space, with students sitting together more and gradually adopting greater physical proximity in tandem with closer social bonds. Having a mutually beneficial justification for this greater proximity seems to have been valuable, and supported other types of paired work elsewhere in the curriculum. There may also be a benefit to students moving around the classroom more, making them less protective over what they see as their own space and more receptive to the idea of the classroom as a shared learning space.

Related to opportunities for greater social interaction was the intrinsic motivation inherent in taking on a tutor role. Teachers referred to the students having fun in this role, which was mirrored in the teachers themselves finding the classroom a more enjoyable space as they were freed from some of the pressure of being the sole source of knowledge or positive reinforcement in the classroom. Finally, the distinctness and novelty of PALS appeared to have some motivational effect. Rather than just saying that they were moving on to mathematics, teachers would tell the class that it was time for PALS. This type of branding reinforced the specialness of PALS and was noted to generate excitement. Over a longer period, it would be interesting to know whether it is better to try preserve this novelty by restricting the use of PALS or if greater benefits come from embedding the strategies across the curriculum so that PALS becomes fully integrated in teaching and learning.

5.12 Helpful materials

Comments related to the helpfulness of PALS teaching resources focused on simplicity and ease of use. Perhaps due to these participants being trainee teachers, their emphasis was often on preparation with particular appreciation shown for reducing the workload by using the ready-prepared daily plans. The trainees teaching the students in the control condition were not given the same level of prepared resources, although it is also the case that they would have had the standard textbooks approved by the Saudi Arabian Ministry of Education so their preparation could also have been minimised.

The PALS materials were praised for being visually appealing, using plenty of images, and being well-organised. While other non-PALS resources are also available that offer similar features, including some very slick commercial resources, being given the resources by a university academic may have increased confidence in the appropriateness of materials and therefore encouraged their greater use. For

example, many published resources from America might feel detached from students' everyday lives, so both teachers and students seemed to highly value that the resources had been made especially for them. Similarly, it is also plausible that feeling part of an experiment discouraged teachers from deviating away from the resources (an explanation supported by the high degree of fidelity shown in classroom observations). This stands in contrast with teachers in the control condition who might feel that personalising and adapting materials is part of their professionalism in preparing for differentiated teaching and learning – although it should be remembered that this is far less common an expectation in Saudi Arabia than in Western countries and the range of teaching resources approved by the Ministry of Education is very narrow.

5.13 Engaging in dialogue

The structure of PALS not only stimulated greater interaction between students, but helped give support to students in explaining problems that they were facing. Rather than the teacher having to constantly assess students' levels and choose appropriate tasks, this support enabled greater self-evaluation and dialogic feedback so that students were able to engage as partners with their teacher in identifying the next steps of their learning. This partnership engaged students as active rather than passive learners enabling better understanding of assessing what they could do and what they had to do in the future. This increase in students seeing themselves as responsible for their own learning was remarkable given the short duration of the intervention, and is highly encouraging for developing self-regulated learning skills in the future.

5.14 Social outcomes

In addition to the benefits mentioned above, which either directly addressed mathematics performance or indirectly improved learning through attitude and classroom management changes, the teachers were keen to discuss social outcomes in their interviews. While receiving more attention in the peer-tutoring literature recently (see 1.18.2 for discussion of the move from social outcomes being added value to being considered ends in their own right), such in-depth discussion of social outcomes was not expected from the participants and serves to highlight just how well these teachers were starting to think about their students as learners rather than worrying about their own performance as teachers.

5.14.1 Social behaviours

Cooperation from PALS interactions was observed to extend into more caring attitudes generally, including greater empathy for students who may have missed previous lessons and improved sharing behaviour. Other examples, such as decreases in arguments between students who did not get on with each other, showed that PALS encouraged more social behaviours. One teacher described explicitly using PALS as an incentive for students to cooperate, that they would not be able to use the fun learning strategy unless they were able to get along with each other. However, improvements were also achieved without such obvious teacher intervention such as Amal's example of new friendship groups forming during free play. Peer tutoring has a symbiotic relationship with personal and social development as well as developing a collaborative learning environment, meaning that PALS has helped beyond just improved understanding of mathematical concepts.

Social cohesion was a very welcome aim for this group since the nature of provision for students with SEN involves regular new additions to the group throughout the school year, whereas class groups in the mainstream setting tend to be more stable over several years and only receive rare new additions at the start of each year. PALS was therefore instrumental in welcoming new students to the class, offering an immediate opportunity for one-on-one interaction which soon developed into playing together. In contrast, a new student trying to get to know everyone in the class at once might not feel as comfortable being the centre of attention.

One explanation for greater social cohesion could be that the one-on-one nature of PALS interactions may help students to see each other as individuals, and therefore be less prejudiced. The simple example of a much older student who had previously self-isolated now proactively engaging in conversation with peers during free time highlights how PALS interactions seemed to help students to see similarities with each other rather than differences. Where differences were still apparent, students were noticeably more accepting of them and showed greater regard for each other as individuals. Saudi Arabia has recently moved from having special schools to having special classes within mainstream schools, so as it moves to the next stage of full integration there may well be a role for PALS in easing such inclusion processes in much the same way as nurture groups are currently used in Western countries.

5.14.2 Ability to work together

Students may have previously had few opportunities to work together, so PALS had to overcome this deficit in skills which may go some way towards explaining the need for teachers to spend significant time training students in how to use PALS at the start of the intervention. However, the lack of prior experience in paired work also meant that PALS could stimulate significant progress in these under-developed skills. Simple skills such as turn-taking were found to be enhanced, indicating that the benefits from PALS could support more collaborative and creative pedagogy in the future. Spencer (2006) highlights how social skills are developed for pupils with EBD by taking on reciprocal tutoring roles, highlighting how other studies have found similar positive outcomes even in challenging circumstances.

5.14.3 Social interaction

One of the risks in using teaching and learning strategies to achieve social outcomes is that the obligatory interaction in PALS could feel too forced for students, meaning that the relationships would be distinct from classroom friendships. However, this seemed not to be the case in this group as new friendships were seen to develop quite naturally among pairs and groups. This may be explained by the underdeveloped social skills of many of the students, so PALS was helpful in giving them a way to start interacting with each other.

As well as giving a structure for interaction, PALS may have been helpful by simply encouraging students to speak. Nada noted a reduction in speaking reticence among her students, with the PALS pairing helping not just with confidence and social skills such as turn-taking but also prosodic considerations such as a more confident tone and an appropriate speaking volume. Similarly, it was noted that students in general were less shy and spoke more confidently and fluently during PALS sessions. This echoes findings from other studies, such as long-term persistence of social skill improvements observed by Gafney and Varma-Nelson (2007) and the wide range of affective benefits reported in a study of students with autism (Jones, 2007).

5.14.4 Patience

Behaviour improvements extended beyond increased time on task and included reductions in more serious misbehaviours, such as students arguing or becoming angry with each other. Comments were drawn together under the theme of patience, which related to students seeing value in taking on a teacher-like role. In many cases

this seemed to develop into a source of pride for students from being able to show that they were patient teachers. This point is supported by Coenen (2002), who describes how skills such as patience were brought out in one school that implemented a programme where gifted students were the peer tutors.

5.15 Academic skills

As well as discussing social outcomes, the teachers were confident that students' academic skills had improved, even if this was not as clear-cut in the quantitative data from the WRAT-4 Maths pre-and post-tests. Afnan's comments exemplified how improvement could be due to a broader, more qualitative interpretation of improvements which went beyond the skills assessed in the WRAT-4 tests. Improvements might also have been more noticeable since teachers were spending more time on feedback and discussion, creating a positive observation bias. Abeer's comments that the lowest-attaining students made the most dramatic progress also suggests that improvements were more memorable for teachers. With such a range of possible interpretations of teachers' views, and the conflict with the quantitative data, it seemed appropriate to return to the data to check some of the ideas teachers raised in the discussion.

The figure below plots pre-test and post-test scores for each individual in the two groups. The dotted reference line shows y=x, which would indicate no improvement (i.e. the same score on both tests). Any points below the line would show that students performed worse at the end of the 12 weeks, and any points above the dotted line show improvements between pre-test and post-test. It can therefore immediately be seen that every student in the study – both control and intervention groups – made progress, supporting the teachers' interpretation but not necessarily showing that these improvements were due to PALS.

The staggered lines in each colour represent a 50% fit line, a more nuanced interpretation aid than a standard line of best fit which is especially helpful when relationships might not be simply linear. For example, it can be seen that the control group (blue dots and line) closely follows the gradient of the dotted line, being slightly more above it at the lower than upper end. This suggests that improvement in performance in the control group was fairly stable, with lower-attaining students improving slightly faster than higher-attaining students. However, the intervention group shows a much gentler gradient and might even suggest a curved line would

be a better fit. The much higher distance from the dotted line at the lower-end than the higher-end shows, as Abeer rightly claimed, that lower-attaining students made much greater improvements than higher-attaining pupils.

It was also noted in the findings chapter that the standard deviation of post-test scores was lower for the intervention group than the control, and this can be seen in the narrower clustering of green dots on the chart. Not only did lower-attaining students make greater progress, but the group as a whole clustered closer together. In contrast, the control group seems to have grown wider apart with two separate clusters of high- and low-attaining students.

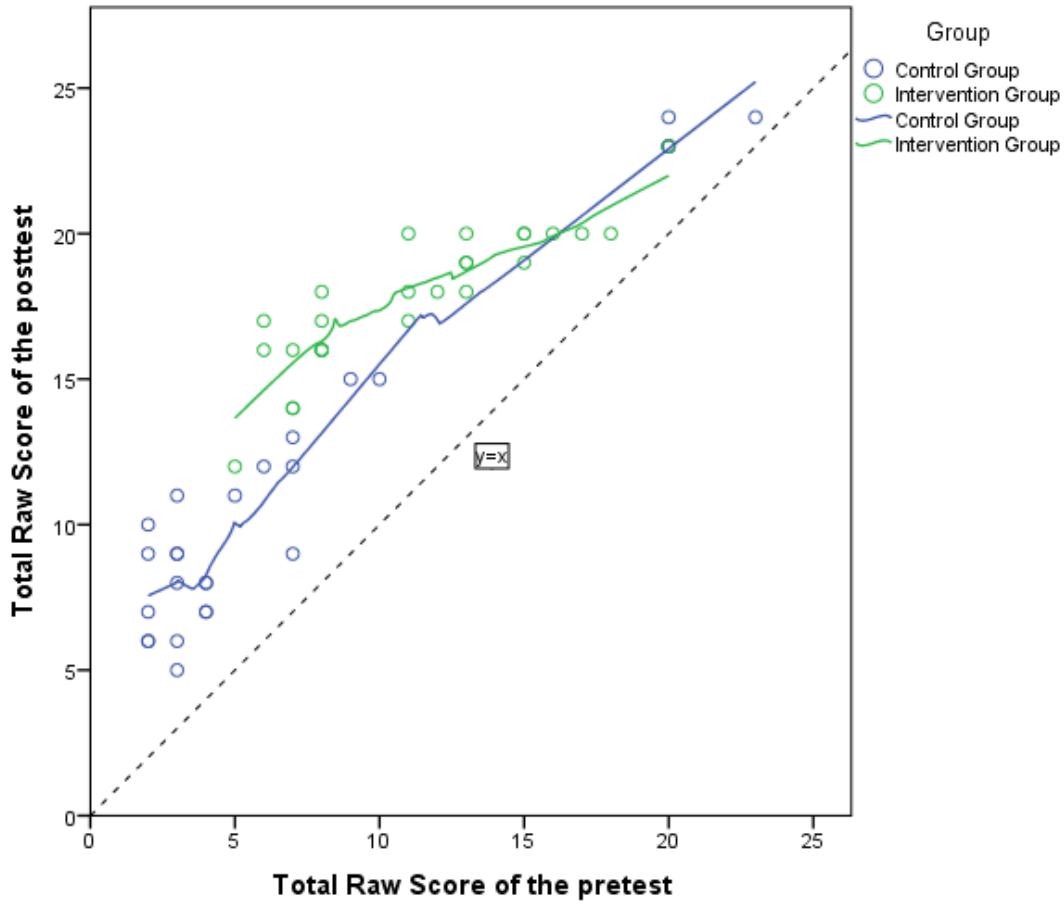

Figure 5.1: Modelling of improvements in the two groups

To summarise:

- every student improved over the course of the intervention regardless of whether they were in the PALS group;
- lower-scoring students in the control group improved at about the same rate as higher-scoring students;

- lower-scoring students in the PALS group improved at a faster rate than higher-scoring students; and

- performance in the PALS group as a whole became more equal, while the control group retained a disparity between weaker and stronger students.

From a social justice perspective, it is very encouraging that PALS helped to reduce the attainment gap. Given that all students still made good progress, the teachers were justifiably pleased with the intervention. However, when compared with the control group there may be a cost in that higher-attaining students seem to make slightly slower progress in the PALS treatment than in the control. Unfortunately, such concerns raised by parents that the most able students are held back (Topping et al., 2017) do seem valid in this study, although the enjoyment scores were much more consistent and suggest that the students themselves did not feel frustrated or that their time was being wasted.

When looking in more detail at the ways in which students had improved, it appears that PALS may be a more suitable treatment for remedying persistent problems or misconceptions. One concern raised by trainee teachers is deciding on a suitable pace in mixed-ability classrooms, especially those where some students have SEN (Lambe & Bones, 2008), so it is encouraging that PALS seems to help in this regard. This is liked to Amal's comment that she was shocked that some students could not count using their fingers, making it difficult for her to know how to address this at whole-class level. PALS not only helped Amal to notice the problem, but students to see for themselves how a peer could use a strategy while avoiding frustrating those who did not need to revisit this technique. This type of student-led modelling also offered some students an alternative way to learn how to count on fingers, giving another learning opportunity for students who had not learnt the skill sufficiently when it had previously been taught (presumably using traditional didactic pedagogy).

5.16 New roles for students

Some students adapted very well to the tutor role and were clearly engaged by the challenge of explaining ideas to peers. Amal felt that this helped those students to consolidate their own knowledge, which is supported by the idea of rehearsal. For example, Smith's (2007) study explains how new knowledge is consolidated by then teaching it to their peers and may actually lead to more learning for those in the tutor

role than in the pupil role. This rehearsal is also noted by Topping, Buchs, Duran & van Keer (2017) who describe one of the advantages of peer learning to be a chance for teachers to observe pupils closely whilst they are constructing knowledge.

Students also seemed to acknowledge different learning preferences and the need to explain ideas in different ways. This reflected increased empathy for other students, an important development in their emotional intelligence and spiritual, social and moral development (Radford, 2003). It has also been argued that tutors having soft skills related to emotional intelligence might also be more important for the success of PALS than the intelligence of those tutors (Lundmark, Paradis, Kapp, Lowe, & Tashiro, 2017). This implies that as well as students developing some skills which had previously been deficient, they were developing skills which would enable them to be better at PALS in the future. For example, moving from selecting tutors based on academic performance and instead selecting based on "empathy, creativity and approachability" was found to improve the pass rate of students tutoring as part of a PALS intervention by 20% (Lundmark, Paradis, Kapp, Lowe, & Tashiro, 2017, p.50). This further supports the idea that longitudinal evaluations are needed to fully appreciate the range of positive outcomes that can come from PALS.

5.17 Finding an explanatory framework

The literature review chapter set out how PALS and peer-tutoring more generally have developed over time, with various types of implementation and theoretical or philosophical justification and rationalisation. It was noted that the literature was deficient in its consideration of non-Western contexts, and that the popularity of peer-tutoring had resulted in a growing lack of precision not just in how terminology was used but arguably in the fidelity of implementation. More generally, however, the literature also lacked a clear theoretical framework for why peer-tutoring was effective and what was meant by effectiveness.

Attempts to address this when considering peer-tutoring at university level (e.g. Tai, 2015) have drawn on the student approaches to learning literature (e.g. Entwistle, 1988) and constructivist values articulated through self-regulated learning (Falchikov & Boud, 2007), or more narrowly in the literature on feedback being a means of developing self-assessment capabilities (Sadler, 2010). At school-level, however, this theoretical foundation is lacking. One text by key authors in peer-tutoring has the potential to address this problem through introducing the concept of "constructive

interactions" (Topping, Buchs, Duran, & Van Keer, 2017, p.35). Published during the data collection and analysis stage of this current study, the new work from Topping and colleagues was unable to influence the design of this study, but consequently offers a valuable opportunity to help explain its findings through a fresh lens. This explanation is therefore the focus of this sub-section.

5.18 When PALS can be used

Despite the overwhelming positive response to PALS, consensus remained that PALS was a supplementary tool and would not be suitable as the main pedagogy in mathematics classes. This illustrated how PALS was seen as a way for students to practice or reinforce skills, with the teacher still being relied upon for input and teaching new concepts. Due to this, PALS does have restrictions and extra non-PALS materials would need to be put into place so they could be used when concepts were first introduced.

These reservations aside, four of the five teachers were confident that they would continue to use PALS in some form. Some teachers saw PALS as helping to change their fundamental views of teaching and learning, so there was a clear link between using PALS and valuing constructivist approaches to learning. Enthusiasm among colleagues also acted as an incentive, helping these novice teachers to gain self-esteem by sharing their new expertise with more experienced staff who were keen to try PALS for themselves.

In keeping with other studies (e.g. Stein et al., 2008; Topping, Miller, Thurston, McGavock, & Conlin, 2011), PALS was also found to be helpful in reading. This seemed to be a spontaneous decision on the part of some teachers and so was not as formally introduced or resourced as Maths PALS, nor was it part of this evaluation study, but comments suggest that PALS positively influenced how students approached any type of paired work in other lessons and therefore encouraged the teachers to use PALS-like approaches elsewhere.

One interpretation of teachers' reluctance to commit to PALS as a dominant teaching strategy could be its novelty. For example, two teachers mentioned that they would like to learn more about the underpinning theory and philosophy of PALS, implying that they needed to feel comfortable with the foundations of the approach before they could trust it entirely. Such reflection among trainee teachers is to be encouraged, so although time pressure meant that the PALS training offered to these teachers

had a highly practical focus, this is useful feedback for the training. More significantly, however, it shows that positive outcomes alone are not sufficient for teachers to take on such radically different pedagogy: teachers may also need to know why something works, have confidence that it will remain efficacious in the longer term, and be able to match the underlying theory of a new approach to their own personal values. Having this more secure base in their own knowledge may also assist teachers in seeing the potential of PALS in other subject areas. For example, they discussed potential value for PALS in reading and Quran study, but did not elaborate on how the approach may need to be adapted for different contexts and so might appreciate more support from their university.

Being more secure with the principles underlying PALS may be especially helpful for ongoing reflection as teachers seek to integrate PALS into their pedagogy and make any changes they feel necessary for a particular group of learners. An example of PALS implementation by an experienced teacher over an extended period shows how it was crucial that the teacher fully understood what were the essential aspects of PALS so that she could decide what she could vary when attempting to adapt the approach (Torres, Farley, & Cook, 2012). Without this background in principles and philosophy, piecemeal adaptations could result in compromised fidelity and potentially damaging results.

5.18.1 PALS and constructive interactions

The educational goal of peer tutoring is enabling students to better regulate their own learning, but there is also an important social goal of students becoming cooperative learners (Topping et al., 2017). Within this framework, peer-tutoring is distinct from peer learning more generally through being directional rather than mutual – that is to say, the learner role alternates with a tutor role. While there are clear learning benefits from taking on a tutor role, this distinction of direction from a tutor to a pupil makes peer-tutoring different from other forms of learning together. PALS adds a further level of precision, with tutor roles being short-lived and addressing a very specific outcome which a teacher has targeted for a particular learner.

This distinction means that PALS does not necessarily rely on constructivist approaches to teaching and learning, and can emphasise practice and routine correction rather than incremental learning (Topping, 2005). It also means that, compared for example with task-based learning, outcomes are not determined by

learners and are not necessarily mutual goals for both students in a pair. This removes a key element of self-regulated learning since it reduces the opportunity for students to develop evaluative judgement and identify their own future learning goals, with PALS instead focusing on intense feedback and practice of a specific task or skill. The frequent changing of pairs according to these short-term goals likewise reduces emphasis on relational factors of peer-tutoring, which makes the affective and social outcomes found in this study all the more remarkable. Nevertheless, the changing of pairs emphasises that relationships within pairs are secondary to relationships across the tutoring group as a whole, and that these relationships are themselves secondary to the specific mathematical outcomes as determined by the teacher.

Understanding PALS within this broader context helps to regain control over some of the confusion that has crept into terminology in peer-tutoring over recent years, and is also an important distinction to make for the sake of understanding the fidelity of implementation as evaluated in the observation schedules. So far, however, locating PALS within self-regulated learning, and in contrast with task-based learning and cooperative learning, has focused more on practicalities than it has on providing a consistent theoretical framework. The remainder of this section therefore seeks to remedy this deficiency by drawing upon the concept of constructive interactions (Topping et al., 2017).

5.18.2 Meeting the environmental conditions for constructive interaction

As a concept, constructive interaction starts with the premise that spontaneous interactions among peers can be ineffective. While a Piagetian interpretation of constructivist approaches to learning might see spontaneous interaction developing into more purposeful learning over time, constructive interaction takes a firmer Vygotskian stance in which interaction needs to be more structured and involve disparities of knowledge or skill. More practically, planning for constructive interaction aims to compensate for natural dispositions for superficial interactions or explanations from tutors or a tendency for tutors to dominate and therefore reduce scope for questioning and dialogue. This position seems surprisingly cynical given the assumption that education in Western countries follows constructivist principles, with constructivism used almost synonymously with modernism (Hamdan Alghamdi, 2014). While it might be assumed that students in Western countries are well-prepared for social learning, the need to train students for constructive interactions

is based on arguments that classrooms are often highly competitive places where group work is relatively uncommon, that teachers tend not to trust students with the necessary freedom for genuinely collaborative student-led learning, and that failing to adequately prepare students will waste significant amounts of learning time due to “disorganised behaviour from students” (Topping, Buchs, Duran, & Van Keer, 2017, p.35). Suitable preparation for constructive interaction is therefore arranged to address the developing and reinforcing good habits in students, structuring tasks to support desired behaviours and discourage undesired behaviours, and teachers effectively monitoring interactions.

If these assumptions seem overly cynical in a Western context, they may be more readily accepted in a Middle Eastern setting. Group work has been noted as especially challenging, particularly when students are not under direct instruction and do not value the input of their peers as much as input from their teacher (Al-Seghayer, 2014). Further, classrooms in Saudi Arabia are generally regarded as more chaotic than their Western counterparts based on a lower standard of teacher planning and behaviour management preparation or skill (Alnahdi, 2014). Students also stereotypically appear to assume very passive roles and take very little responsibility for their own learning. For example, foreign teachers relocating to Saudi Arabia have complained in other studies that Saudi Arabian students take very little responsibility for their own studies (Springsteen, 2014). Preparing students in Saudi Arabia for constructive interaction therefore arguably has greater challenges to overcome than similar PALS implementations in Western classrooms.

It is therefore encouraging that student attitudes in this study were so substantially improved in this short intervention, especially using trainee teachers whose behaviour management skills would presumably be less developed than the regular class teacher. However, using novice teachers may actually help to introduce new norms to the classroom since the power distance is neither as great nor as established as for the regular class teacher. This means that the new teacher does not have to work to reduce the power distance between them and their students, nor has to worry about giving up any hard-won authority. The novice teacher may also not have such strong expert status, making it easier for peers to see each other as credible alternatives. PALS may be especially helpful in this respect too since the materials have status and legitimacy, in this case through coming from the university. Another contributing factor could simply be that the novelty of a new approach is

associated with the novelty of a new teacher and the additional novelty of being part of a university study, creating an environment more conducive to trying new approaches.

As well as fostering a more receptive approach to change and developing greater respect for the contributions of peers, constructive interaction is seen as underpinned by cooperative norms and beliefs as part of general classroom rules (Topping et al., 2017) rather than being short-term rules or guidelines used only during a specific intervention. These values are set out in Rouiller and Howden (2010) and summarised from the original French by Topping and colleagues as "respect, engagement, openness, helping each other, the right to differ, solidarity, trust, sharing, pleasure, autonomy, equality and empathic listening" (Topping, Buchs, Duran, & Van Keer, 2017, p.36).

Clearly, Rouiller and Howden's set of values (2010) reads as more of a wish-list than a set of absolutely necessary conditions, but the values nevertheless serve to highlight how PALS needs to function within a cooperative learning environment to be considered as constructive interaction. Summarising more generally, these values can be seen as moving more towards "collective concerns (you need to do this in order to work together successfully) more than the normative aspect (you need to do this because I say it is the thing to do)" (Topping, Buchs, Duran, & Van Keer, 2017, p.36).

As well as this general attitude to mutual benefit, other values from Rouiller and Howden (2010) can be grouped together so that, for instance, openness is seen not as a distinct value but more as relating to trust. Drawing on the separation of trust into requiring students to be both trusting and trustworthy (Johnson, Johnson, & Holubec, 1998), it can be seen that the longer list of values can be neatly summarised under two main headings of being cooperative and developing trust (Topping et al., 2017). Put together, constructive interaction therefore requires that students are engaged in the idea of mutually beneficial endeavour to the extent that they are willing to take risks in their learning or emotional security since they feel secure that their risk-taking will be treated appropriately by their peers.

PALS, more than many other types of peer-tutoring, may have difficulty in establishing trust and reciprocity due to the frequent changing of partners and the brief, transactional nature of paired interactions. Trust therefore needs to develop

across all the individuals in the group rather than being allowed to develop gradually and accumulate from trust among pairs to trust among groups and then to the whole-class. One obvious benefit of this is that when trust does develop it leads to a much more pleasant classroom environment, and this is reflected in comments from the teachers that the class as a whole became more supportive and inclusive even during free play periods. This might also account for the intervention taking longer to show benefits in performance, since the wider network of trust will necessarily take longer to develop than trust in sets of pairs as in other peer-tutoring interventions or trust in the new teacher as in the control group in this study.

PALS also introduces a firmer structure than many other peer-tutoring interventions, and trust in these roles may help to establish a baseline of trust so that the intervention can begin. For example, explicit rules for respecting turn-taking and other conversational politeness norms such as not dominating an interaction can help to make interactions successful while values of respect develop more naturally. This structure may have been especially necessary in this context where students were not as familiar with waiting for each other to speak and are more familiar with rules being set from above. In contrast, the more general trust-building exercises recommended as preparation for peer-tutoring such as leading around a blindfolded partner (Topping et al., 2017) or negotiating classroom rules (Castle & Rogers, 1993) may have simply seemed too different from the learning environment with which students are familiar.

Having established an appropriate classroom climate and core values, constructive interaction next requires a focus on learning rather than task completion. While Topping and colleagues (2017) do not make the link, there are clear parallels here with the work previously discussed regarding the developing views of trainee teachers (Twiselton, 2000). Just as the trainees in Twiselton's study gradually shifted from thinking about what tasks they asked students to do and into thinking about the purpose of the tasks, so too does constructive interaction rely on students wanting to learn from tasks rather than merely wanting to complete the task. This deeper engagement relies on greater opportunities for dialogue, and might therefore be limited in PALS due to the decreased flexibility and increased time pressure compared with other forms of peer learning.

The final prerequisite for peer-tutoring to be classified as constructive interaction relates to these efforts to reduce competitiveness, and is perhaps the most

challenging for teachers to influence. Pointing out the fragility of peer-tutoring strategies at the start of the implementation, making sure that parents are in agreement with the principles of the approach is suggested as “an important ingredient to success in peer learning” (Topping, Buchs, Duran, & Van Keer, 2017, p.41). Parents in Saudi Arabia are described as highly resistant to change, favouring traditional authoritarian approaches which focus on the knowledge of the teacher being transmitted to passively receptive children (Hamdan Alghamdi, 2014). This relates closely to the concern raised about parents in Western cultures who “can share a traditional conception about learning and teaching, and may not only be reluctant for their children to use group working but perceive collaboration and helping other students as a waste of time” (Topping, Buchs, Duran, & Van Keer, 2017, p.41).

Another concern, that parents may feel embarrassed that other students are wasting their time helping their child, may also be more keenly felt in Saudi Arabian culture in which causing embarrassment is treated extremely seriously as misbehaviour since it is seen as a direct challenge to parental authority (Dwairy et al., 2006). It has similarly been argued that embarrassment is increased for some parents of children with special educational needs in Saudi Arabia (Aldosari, 2013), which adds further emphasis to the challenge of suitable parental involvement in this study.

The advice to “explain to parents that learning is a social product, that cooperation is a key competence in today’s society” (Topping et al., 2017, p.41) may be difficult to follow in a Saudi Arabian context, although as the country seeks to internationalise as a response to globalisation (Kingdom of Saudi Arabia Ministry of Education, 2017) this situation may improve.

5.18.3 Student skill conditions for constructive interaction

Cooperative skills can be developed through participation in peer-tutoring interventions, including PALS, but there is also a case for students needing to be prepared with cooperative skill development prior to an intervention. A wide range of skills are recommended by various authors, but they are helpfully summarised within the constructive interaction framework as “cooperative skills” sub-divided into four domains: forming skills, functioning skills, formulating skills, and fermenting skills (Topping, Buchs, Duran, & Van Keer, 2017, pp.42-3). Without this skills development

preparation, the intervention may be less effective, be implemented with less fidelity, or take a longer time to show positive outcomes.

Forming skills relate to simple routines by which groups are formed, and can be thought of as relating to classroom management. For example, they include how quickly students can get into assigned pairings, start tasks without being directly supervised, avoid distractions, and keep any discussions to an appropriate volume to avoid disturbing others. Using this category of forming skills, many of the comments made by the teachers in this study about how students learnt to adopt PALS can be seen to relate to these forming skills. Part of this may simply be that trainee teachers tend to be concerned about behaviour management and students completing assigned tasks anyway, but it also suggests that these core skills took significant effort in this intervention.

The category of functioning skills includes what might be expected from students who are generally fairly good at working in groups. At a basic level, this includes being confident enough to speak or ask questions without needing to be invited. Functioning skills can also include supporting others, offering explanations, reflecting back group ideas through paraphrasing or summarising, and simply adding enthusiasm or energy to the interaction. Again, there seemed to be evidence of these types of skills developing during the intervention, with some teachers pointing out students who had made good progress in confidence and cooperation. However, while the class had generally good forming skills, only a few students would have been considered to have sufficient functioning skills prior to the intervention. This category is therefore helpful by providing a name for the skills which have been developed through Maths PALS, and also highlights more specific deficiencies in the group's baseline of cooperative skills prior to the intervention, thereby showing a potential reason for the slow academic progress made.

Moving through to the final two stages of complexity, formulating and fermenting skills are described as supporting "a deeper level of understanding and quality of reasoning strategies" and suitably "challenging the conclusions and reasoning of others", respectively (Topping, Buchs, Duran, & Van Keer, 2017, p.43). Some of these are clearly require higher-level cognitive abilities, such as integrating ideas or probing using in-depth questions. Others show advanced social skills such as being able to criticise an idea without criticising the person who offered the idea. Other skills and habits could be easily coached into a routine, such as summarising aloud

or asking for justification. Based on the interviews, such skills were observed rarely. However, there were some signs that some of these skills were starting to develop, particularly social skills, as students gained confidence engaging in dialogue. Given their starting point and the short intervention, this is an encouraging result. It should also be noted that maths PALS puts less emphasis on dialogue than many other peer-tutoring implementations, so such skills may develop more as the teachers experiment with PALS-inspired approaches across a wider range of curriculum areas.

It is highly encouraging that students made such rapid progress on the first two levels of these cooperative skills, and some students even started to show potential for the higher-level skills. While constructive interaction appears to require these skills to already be developing if peer-learning is to be successful, this did not seem to be as strong a pre-requisite in this study as might be expected given the low pre-intervention cooperative skills of these students. One possible explanation is that PALS is perhaps less demanding than peer-tutoring implementations which rely on students as tutors to consider assessment and planning for next steps, or to provide richer dialogue, since these more complex tasks are still largely controlled by the teacher. Nevertheless, some cooperative skills will still have been necessary prior to the intervention and may be assumed to be less developed among students in Saudi Arabia than for their Western counterparts, therefore requiring greater investment in preparing students for peer-tutoring before introducing it as a main teaching strategy.

5.19 Contributions to knowledge

As argued in the literature review, Saudi Arabia is currently under-represented in educational research. Given the recent major changes in education policy in the Kingdom, what little research that does exist may also soon become far less relevant. This study therefore makes an important contribution by offering rare insight into how trainee teachers are finding their way in the changing education system. The study also presents a setting which is uncommon on a global scale, that of a single-sex special education class, offering a fresh perspective on how PALS can operate in different settings.

The mixed-methods design has also enabled a qualitative evaluation of PALS, with the added benefit of contrasting this with a more typical quantitative evaluation. Discussion of the limitations of quantitative evaluations of student progress also

raises some concerns regarding assessment strategies and the incompatibility of current mathematics assessments with recent education policy changes. In addition to these contributions to qualitative understanding of PALS and PALS in a Saudi Arabian context, this study also claims contributions to knowledge in the fields of teacher education in Saudi Arabia, education change management, and assessment design in Saudi Arabia.

5.19.1 Contribution to the education change management literature

Academics are famously resistant to change, especially when changes are perceived as being imposed from above (Trowler, 1998). As Trowler points out, resistance to change can include ignoring change, frustrating change agents with unnecessary discussion, or offering token compliance. Academics, and particularly teachers, can also be resistant to change which they feel does not respect their own professional autonomy, judgement and discretion. Recognising that teachers have a great deal of power over the day-to-day running of their classroom in a role described as street-level bureaucracy, it has been argued that teachers are well-placed to interpret change to suit their own preferences (Lipsky, 2010). This difficulty of not knowing if or to what extent change has actually been implemented means that the literature on education change management is always in need of genuine insight into how change really happens in the classroom, with research from those with privileged or insider status being especially valuable for its added truthfulness.

Resistance to change is also a key aspect of discussion in the peer tutoring literature, with persuading colleagues to try and then stick to a new approach being a key barrier to implementing new student- and peer-led strategies (Falchikov, 2001). More experienced teachers have been noted to prefer the repertoire of pedagogy with which they are already familiar, changing only when confronted with a crisis (Coburn, 2004). Examples of less effective PALS interventions have discussed how experienced teachers might resent some forms of additional support, resulting in less progress than if teachers were simply trained in PALS and then left to implement it alone (Stein et al., 2008). This present study therefore makes an important contribution to those designing PALS training or interventions by showing that the best way to train students is to regularly reinforce PALS techniques over a few weeks. However, as with the study by Stein and colleagues, a high level of researcher involvement and fidelity checking might actually worsen outcomes and so needs to be used judiciously.

There is also literature relating to resistance to change from students which must be overcome with any new teaching and learning strategy (Arendale, 2014), although this may be more of an issue with university students than school-aged students. Nevertheless, some of the tensions listed in a study of medical students taking on peer-tutoring roles (Tai, 2015) appear to be relevant when considering these trainee teachers and their students. Tai described tension in PALS implementation as either educational or relational. Educational tensions included the novel approach of PALS contrasted against traditional pedagogy being seen as “expert-led”, and two tensions in the student role: equal partners in learning vs. absorbers of teaching, and student as contributor to the learning of peers vs. students as novices (Tai, 2015, p.243).

The other two tensions observed in Tai’s study were relational. The main tension was providing feedback which was honest, and therefore potentially upsetting, vs. “maintain collegial relationships and supporting each other” (Tai, 2015, p.243). This study showed that similar tensions were not problematic in this setting, which is remarkable given the students’ poor prior social skills. Indeed, the teachers each commented that the class as a whole improved their skills in cooperation and emotional support over the course of the intervention. One explanation may be the different age and educational setting of the students compared with Tai’s study. Alternatively, the difference could be an outcome of the more structured style of the PALS intervention in this study. Regardless of the reason, this study offers as a contribution the finding that this relational tension is not a significant concern in this setting.

Finally, related to the medical context of her study, Tai noted a tension between the needs of students and the needs of patients. There are clearly important quality control and safeguarding issues in a medical context, but a similar tension can be seen in this study with teachers having to decide whether they are willing to accept lower (or, at least, slower) progress in mathematics in exchange for affective or social skill improvements and, potentially, longer-term performance gains. In a school setting, it is important to consider this in the context of high-stakes assessment. In particular, students in Saudi Arabia are unable to progress between different phases of education unless they pass the required exams. This study therefore highlights how teachers considering PALS will need to think carefully about the timing of the intervention and be cognisant of their responsibility to consider when they have the

luxury of focusing on longer-term learning and when they need to adopt more strategic approaches to help meet their students' immediate needs.

5.19.2 Contribution to PALS in special education settings

This present study offers what appears to be unique insight into PALS in female-only small-class settings for students with Special Educational Needs. Given that such arrangements are much more common in Saudi Arabia than in Western countries, this contribution could have strong transferability to these similar settings and make a welcome contribution to knowledge for practitioners in Saudi Arabia's special education system.

The study may also make some contributions to areas where there is already some literature. One area is in cross-age peer tutoring. Topping (2005) notes that cross-age peer tutoring tends to deliver better outcomes and larger effect sizes than same-age peer tutoring, but this trend has so far only been observed in Western settings where classes tend to be arranged by age. There are still very few circumstances in Western countries where cross-age classes are common, so it is difficult to know whether Topping's (2005) claim is influenced by the novelty of cross-age tutoring arrangements in settings where they are uncommon. Studies such as this one can help tease apart this distinction, although since Saudi Arabia will rarely offer a same-age comparison it will be difficult to make direct comparisons across settings.

The study also contributes to peer-tutoring in settings dedicated to those with special educational needs. For instance, just under 50% of students with SEN are taught in special schools in Saudi Arabia (Al-mousa, 2010). This contrasts dramatically against the latest figures for England which show only 5.4% of students with SEN attending special schools (UK Department for Education, 2017). Any practitioners looking for advice on peer-tutoring in special schools would therefore find that the UK-based literature is sparse and relates mainly to students with more profound needs. This study therefore makes a contribution to this area, which could be especially valuable for practitioners in special education settings which do not follow the UK model. In particular, teachers in settings similar to Saudi Arabia may find a much broader range of needs but, overall, less severity of need among the group. This presents its own opportunities and challenges for arranging peer tutoring which have yet to be discussed in the peer-tutoring literature.

5.19.3 Contribution to mathematics assessment design in Saudi Arabia

Saudi Arabia's plans for more authentic assessment tasks and modernising of pedagogy have been developing over the last 10 years, with significant changes in official Ministry-approved textbooks (Alshehri & Ali, 2016). The Ministry of Education has been able to take a firm approach to change since it controls not just the curriculum but assessments and official textbooks through the Obeikan publishing Strategic Business Unit. A recent analysis of these textbooks shows strong alignment with global standards for mathematics education, with 96.3% of the US National Council of Teachers of Mathematics (NCTM) standards addressed in these official government textbooks. Unfortunately, there are currently no studies seeing if this is also consistent in official examinations, and past papers are not publicly available. It might still be the case that examinations as part of the Elementary Education Certificate are only assessing the same narrow range of skills as before these curriculum changes were implemented.

This study offers some initial insight that performance gains were demonstrable for both the intervention and control group using the WRAT 4 assessment tool. As the name suggests, this assessment aims to evaluate a wide range of achievement and therefore has a skills-based focus with computational skill being the key aspect of the mathematics component. It can therefore be suggested that both the PALS and control resources were effective for general mathematics improvement. A follow-up comparing performance of the two groups on the Elementary School Certificate mathematics exams might therefore add helpful comparisons to see how WRAT 4 scores relate to scores on Saudi Arabia's new mathematics test.

More broadly, the study showed that teachers put a great deal of emphasis on students developing social and problem-solving skills. It might therefore be worth considering more novel forms of assessment that reward such behaviour, with PALS providing a strong foundation for collaborative approaches to assessment as well as learning. Examples of this type of assessment have shown it to work well at university and FE level (Fagen, Crouch, & Mazur, 2002), so could prove viable for these teachers to try as part of their formative assessment strategy.

As noted in the methodology chapter, the WRAT 4 mathematics assessment tool is well-established and has been used in several countries – although these are all Western countries. Using this tool therefore makes several small but nevertheless

worthwhile contributions. First, it offers a translated version of the assessment which has been checked with focus groups and piloted and so might therefore be useful to other researchers keen on checking the suitability of WRAT 4 in a Middle Eastern context. Second, it gives some small quantitative data showing rates of progress in WRAT 4 for a group of students with SEN in Saudi Arabia, so gives at least an initial benchmark for any studies which cannot use a control group. Finally, this study shows that WRAT-4 Maths is sensitive enough to detect progress over a relatively short intervention and is easy for students to use, suggesting that it might be a useful tool for formative assessment if enough translated tests can be made available to teachers.

The Attitudinal Questionnaire Regarding mathematics is similarly a valuable contribution to researchers or practitioners looking for a robust tool for evaluating student attitudes. Extensive piloting and discussion of the appropriateness of items helped to adapt an established attitudinal questionnaire (Barber & Houssart, 2011), creating what appears to be a unique contribution of a survey tool which has been created for a Middle Eastern context whilst also offering some points of comparison with existing studies in the West.

5.20 Implications for participants

This study reaffirms many of the findings in the existing Western-centric research literature on peer-tutoring, suggesting that there is transferability from this literature into Saudi Arabia. As found in a large-scale study of peer-tutoring for reading in Scotland, the effect size for same-age peer tutoring was often moderate or even negligible, but improvements to student affect were substantial (Topping et al., 2011). However, the study by Topping et al. (2011) does still seem to be influenced by the effect of gender in mixed groups, which can limit transferability to Saudi Arabia's single-sex setting.

For example, Topping and colleagues (2017) noted that female students made more progress than male students both within and between groups (i.e. female students performed better than male students in both the intervention and control groups, female students in the intervention group performed better than female students in the control group, and the gains of the intervention over the control were stronger for female students than their male counterparts). Given that this present study sampled only female students, a sampling effect might be expected so that this study showed

a stronger effect size than would be found in a mixed-gender study. This means that the study in Scotland found that girls engage more with peer tutoring than boys, but they didn't have any groups which were just made up of girls. We therefore don't know if girls do better than boys because of how boys and girls interact, or if girls still do better than boys when on their own. Since the effect size was instead comparable to the mixed class results, it may be the case that tutoring was less effective in this study than in the Scottish comparison, or that the gender effect found in the larger study is not as significant in a single-sex education setting (a rarity in Scotland, and not present at all in the actual study).

As discussed in the following section, PALS differs from many peer-tutoring implementations in that it does not place as much emphasis on learning gains for those students in a tutor role as it does for students in a pupil role. This is a key aspect of Topping's (1996) definition of peer tutoring, but more importantly has been argued to be a stronger learning gain than that achieved for students in the pupil role (Topping et al., 2017). The emphasis on mathematical outcomes as evaluated by the WRAT 4 test combined with this aspect of PALS meant that benefits to tutors were not separately evaluated from benefits to pupils. Such benefits might also be of little interest in Saudi Arabia since such soft skills are still relatively under-valued. Nevertheless, there is a clear implication that benefits for participants could extend beyond those evaluated in this study.

5.21 Evaluation of strengths, weakness and limitations of study

As a quasi-experimental mixed-methods study, this project offered several innovative perspectives. In this section, some of the limitations and compromises necessary for this innovation are discussed as well as a more general overview of the study's strengths ahead of recommendations for future research in sub-section 5.22.

5.21.1 Evaluating the usefulness of mixed methods

One of the key strengths in the methodology was quantifying performance using a standard test. This was chosen during the planning stage to add rigour to the study and was in keeping with research design guidelines for intervention studies. As discussed in the methodology chapter, the use of a standardised test adds impartiality, meaning that the researcher and participants cannot be misled by bias. There are also established methods for checking the reliability of tests, and the WRAT-4 Maths subtest passed these.

It is a key strength of mixed methods designs that contradictions can be uncovered (Plowright, 2011), so being able to look at test performance as well as teachers' views was essential for explaining student performance. This study was able to add greater insight by drawing together multiple data sources and applying data transformations, such as controlling for age. For example, an evaluation using just the WRAT-4 Maths subtest results without controlling for age would have concluded that PALS had only a slight or even negative effect on mathematics performance, and may have recommended against further use of PALS. Conversely, a qualitative-only study using just the views of teachers in the interviews might not have found these potentially negative outcomes and therefore left practitioners looking to emulate the intervention confused if they did not see improvements in raw exam scores. A challenge for evaluating the results of this study is deciding which type of data should dominate the interpretation and avoiding the potential downside of sequential mixed-methods designs that the first results overly influence interpretation of subsequent results, creating a confirmation bias effect (Biesta, 2017).

Overall, mixed-methods was crucial to the success of this study and would be strongly recommended for similar studies where contradictions between different outcomes or perspectives might be anticipated or where there are doubts about the relevance of the existing research literature. This need to understand the complexity of the impact of PALS also adds an important note of caution to teachers conducting their own small-scale or action research studies, since some statistical manipulations might be required to fully understand the impact of the intervention.

5.21.2 Intervention fidelity

The observation schedule provided a clear indication of fidelity according to the specified criteria. However, as already mentioned, the simplicity which enabled a high degree of inter-rater reliability had the downside that nuance was lost since fewer qualitative judgements needed to be made by the observers. A more qualitative observation schedule may have looked more at how well or to what extent the principles of PALS were implemented. This relates not just to the skill of the teacher or training given to students adopting tutor roles, but more broadly reflects the impacts of classroom and even national culture. For example, it has been argued that interventions such as PALS should clearly follow Vygotskian approaches rather than Piagetian so that there is a clear distinction between how the ideal peer interaction is conceptualised (Topping et al., 2017). Given that constructivist views

are in the minority in Saudi Arabia anyway, appreciating such nuances could be a key challenge for the future.

Fidelity with the practices of PALS, as addressed in the interview schedule, was important to establish for the validity of inferences made to address the research questions of this study. However, it is arguably both a strength and limitation that the broader educational context of this case study reflected such strong traditional and authoritarian views of the role of the learner. Seeing how PALS can help to broaden a teacher's view of learning and how well PALS can work in a traditional setting is valuable, but it might also be argued as a limitation since PALS in this context may be so significantly different from PALS implementations in constructivist settings that cross-cultural comparisons are limited.

Differentiation of PALS in terms of its practical implementation can be performed using three criteria: equality, mutuality, and degree of structuring. On these criteria, peer-tutoring is described as low on equality, low-moderate on mutuality, and high on degree of structuring (Topping, Buchs, Duran, & Van Keer, 2017, p.3). This helps to distinguish peer-tutoring from other types of peer learning. For instance, low equality means that the tutor controls information or the agenda, while other collaborative learning implementations might allow peers to negotiate distribution of tasks or choose from a range of strategies. In PALS, equality defined in this way is even lower since the agenda is very specific and set by the teacher rather than the peer in the role of tutor. Similarly, peer-tutoring having low-moderate mutuality contrasts against the higher mutuality of other peer learning implementations which emphasise a common goal and mutual benefit. This is perhaps the most controversial criteria for describing PALS as a type of peer-tutoring, since there is a great deal of mutual support across the class even if mutuality is not directly reciprocated among pairs. Finally, structure is higher in peer-tutoring since both the task and material are determined by the teacher. This is similar to cooperative learning, and is arguably even more tightly structured in PALS since the timing and specific focus of each interaction is set in advance by the teacher. In contrast, peer collaboration such as through task-based learning has a greater allowance for spontaneity.

The key principle of peer-tutoring is role disparity since this is a key Vygotskian principle in how learning occurs, making a clear difference between tutor and pupil roles "an essential characteristic of peer tutoring" (Topping, Buchs, Duran, & Van

Keer, 2017, p.16). Crucially, this is not the same as status disparity as might exist in the traditional teacher to student relationship. While tutors have an expert role, their role is “active helping and supporting” (Topping & Ehly, 2001, p.114) and any differences in status are temporary to the specific task, which in PALS will typically be just 25 minutes.

It is also noted that even when students do have different status levels, for example due to age, these differences are far less than between teachers and students. This reduction of distance so that tutors and pupils can communicate in a common language therefore works both in tandem and in tension with role disparity which sets one peer as more knowledgeable than the other. The success of peer-tutoring relies on the reduction of distance encouraging dialogue or questions from the student in a pupil role rather than adopting a passive learner role. This may be particularly significant in Saudi Arabia where dialogue with teachers is less common, in part due to authoritarian traditions in which adults in authority are not questioned even in subjects which emphasise critical thinking and debate (Stoet & Geary, 2017).

Another aspect of peer-tutoring which distinguishes it from other types of tutoring is the intention that the tutor benefits, for example by consolidating their own knowledge or developing their explanation skills. Topping argues that this is essential as part of the definition of peer tutoring (Topping, 1996), but this seems too strong since interventions such as PALS provide benefits to the tutor through all the various pairings for different skills. The tutor in PALS may well develop their own learning through explaining a concept to a novice, but this is not a key goal of PALS – rather, the tutor is incentivised by the promise of learning when they take on the pupil role. Being a tutor in PALS might be rewarding for a wide range of reasons, but the main benefit is being part of a group which allows the tutor to later take on a pupil role, therefore implying that PALS differs from Topping’s (1996) definition of peer-tutoring. As a result, this study might also be seen as lacking fidelity with Topping’s definition as a necessary feature of maintaining its fidelity with the PALS implementation procedures.

Overall, the extent to which PALS is distinct from peer-tutoring more generally may reflect the growing commercial success of PALS. By making PALS something which can be distinct and sold as a prescribed package, rather than a set of principles, fidelity becomes problematic since PALS might be unjustifiably rigid. Deviating from PALS over time might be valuable in terms of student learning and still remain faithful

to the principles of peer-tutoring as a process of constructive interaction, so judging fidelity simply in terms of PALS might be unhelpful for teachers.

One potential oversight of this study was that fidelity of the intervention was focused on ensuring that trainee teachers in the intervention group implemented PALS with a high degree of fidelity, but neglected to ensure that trainee teachers in the control group did not use pedagogy which could be similar to PALS. It was assumed that these teachers would use traditional pedagogical approaches because their teacher training lacked anything else (whereas those teaching the intervention groups had additional training specific to PALS). However, the baseline of trainee teacher knowledge assessed in the Knowledge of Peer Tutoring tool showed a mean score of 46%. While clearly lower than the score of 81% following their training, 46% still suggests that trainees from this university had some knowledge of peer tutoring even without this additional training.

The small sample size also increases the risk that individual differences in pedagogical preferences and skill could be magnified, so it may well have been the case that trainees in the 'traditional pedagogy' control group were still using innovative pedagogy even if they were not using PALS. However, anecdotal evidence from the normal contact between the researcher and all trainees through the teacher educator to trainee relationship suggested that this was not the case. Similar limitations have also been found in other quasi-experimental designs looking at PALS, where it was reasoned that this limitation was important for respecting a teacher's sense of autonomy and, even if teachers in the control condition were using some form of peer tutoring, their lack of materials and training compared with the intervention group was still a significant difference in the two treatments (Fuchs et al., 1994). These justifications apply similarly to this study, although the study would nevertheless have been strengthened by more rigorous analysis of pedagogy used in the control group and this would be an important consideration when planning future studies.

5.21.3 Study reliability

As discussed in the methodology, reliability generally refers to "the dependability, consistency, and/or repeatability of a project's data collection, interpretation, and/or analysis" and is determined different according to whether a study follows a quantitative or qualitative approach (Given, 2008, p.753). For mixed methods

designs, as used in this study, it is important to look at these different standards of reliability in order to arrive at what Plowright describes as the warranted assertability of knowledge claims (Plowright, 2011, p.185). Plowright's standard for reliability in mixed-methods research follows his general argument that mixed-methods is about staying as true as possible to the holistic nature of a research problem. He therefore argues that it is less about establishing or evaluating reliability of specific aspects of a study and more about demonstrating that the interpretation and explanations offered in a study are the most plausible. This sets the standard of assertability in the context of what is currently known in the research literature, meaning that a study must make a case for any interpretation which differs from what might be expected based on the current literature.

First, applying the standards of quantitative research to the quantitative aspects of this study requires demonstrating validity and a narrower definition of reliability. Validity is essentially a check of whether what has been measured is what was intended to be measured, so for example if a test score is a reliable measure of student attainment (Muijs, 2004). Proxies such as this were used for this study's research questions as follows:

- Research question 1: the latent variable of knowledge gains of trainee teachers following PALS training was evaluated using the manifest variable from the Test of Knowledge of Peer Tutoring instrument.
- Research question 2: fidelity of PALS implementation by trainees and students (latent variable) was evaluated using a structured observation checklist (manifest variable).
- Research question 3: improvements in mathematics performance of students in the control and intervention groups (latent variable) was evaluated using the WRAT-4 Maths subtest, giving a manifest variable of test performance as a proxy for mathematics performance.
- Research question 4: the latent variable, changes in student attitudes in the control and intervention groups, was evaluated as a manifest variable using the Attitudinal Questionnaire Regarding Mathematics.

Reliability of quantitative research instruments is used in a more specific sense than the overall concept of study reliability, a difficulty in terminology as mixed-methods

research draws on vocabulary from both quantitative and qualitative traditions as well as introducing its own specific uses of some terms. Regarding the tools used for these four research questions, reliability is used to mean “the extent to which test scores are free of measurement error” (Muijs, 2004, p.71). This sees any data collection tool as generating a true score, some systematic error, and some random error in much the same way as analysis techniques are conceptualised as containing both signal and noise.

While it might seem intuitive that error would be eliminated as a tool develops, there is often a tension between validity and reliability. For example, the structured observation checklist included the item “teacher provides corrective feedback”. Corrective feedback can be defined quite differently in the research literature, suggesting that the observers will need to unpack the meaning and agree on a working definition. For example, it has been argued that feedback must include follow-up action from students if it is to be regarded as feedback rather than just information or “dangling data” (Sadler, 1989, p.121). While this may seem overly strict, Sadler’s interpretation is extensively used in the rationale for self-regulated learning (Falchikov & Boud, 2007). Similarly, feedback might not be thought of as corrective if a student has not made a mistake. Feedback might instead be encouragement, extension, or an invitation to dialogue. Different researchers also prefer different terms to emphasise different intentions of feedback, such as the preference for ‘formative feedback’ (Topping et al., 2017) showing that feedback is intended to be more holistic and developmental rather than just correcting errors (in fact, this latest book no longer uses corrective feedback as a phrase).

To increase reliability of the observation checklist, the problematic “corrective feedback” could be replaced by the much simpler “teacher corrects or encourages students”, or even “teacher offers comments on students’ work” so that there is less doubt or need for interpretation from the observers. However, this simplification might serve to undermine the validity of the observation at the same time as improving its reliability. Corrective feedback is a key aspect of a teacher’s supervision of peer-tutoring, supporting the legitimacy of tutor feedback, but this support can be offered in more subtle ways than simply correcting arithmetical errors. Ensuring that this checklist item has validity therefore requires that it can be used to infer fidelity with the principles of the PALS approach, but this must be balanced against ease of use for the observers.

The reliability of each tool was given in the methodology chapter, so will only be discussed briefly here so that more emphasis can be placed on validity in support, eventually, of warranted assertability. The Knowledge of Peer Tutoring tool was shown to be reliable through using Cronbach's alpha. Described more fully in the methodology chapter, this is essentially a test to see if the items in a questionnaire are related. The inference then is that if they are closely related, they can be assumed to be measuring the same latent variable. Supplementary tests can establish if any questionnaire items should be removed, which is a statistical technique for making the judgement about acceptable signal to noise ratios. Cronbach's alpha was found to be in the recommended range to establish reliability, essentially claiming that the 38 items in the survey were all meaningfully related.

Similar reliability was demonstrated for the observation checklist through checking consistency among multiple observers. Consistency between observers was enhanced through some paired observation, but was already high and soon achieved over 90% agreement. However, with only eight observations in total, interpretation is tentative. The observations give some reassurance that the implementation of PALS was conducted with a high degree of fidelity, which is essential for the transferability of any arguments made since any reader needs to be confident that the implementation in this study matches other studies which use PALS. Beyond this, the regular observations also indicate that teachers and students maintained their enthusiasm for the intervention. As discussed in the section on education change management above, teachers have a large degree of freedom to modify implementations of change in their own classrooms, so it is important to regular monitor for any changes as an indication of how useful they are finding the intervention.

The other two quantitative data collection tools were completed by students, resulting in a much larger number of responses. Reliability was therefore enhanced simply through having a larger sample size. This was especially helpful for reducing the impact of outliers and making them easier to identify. WRAT 4 is also a well-established evaluation tool, extensively validated in several countries. However, it has never been validated for use in Saudi Arabia – indeed, there is no Arabic language version currently available.

From these initial reassurances about reliability, the next step is to ensure validity in that they are all related in the sense that was intended during questionnaire design

(that the items indicated knowledge of peer tutoring). Since both the WRAT 4 and attitudinal survey were completed by students, ensuring that the questions were understood was a key priority in design. WRAT 4 addresses this since understanding the question can be considered part of mathematical skill, but there may still be a familiarity effect that needs to be considered. It is well-established that learning the 'rules of the game' helps students to perform in assessment (Bloxham & West, 2004). In terms of validity, it is important to consider whether this is an effect caused by unfamiliarity resulting in students scoring more poorly than they should on the first attempt or if familiarity enhanced results, meaning that students perform stronger on later attempts. The size and extent of these effects would also presumably vary based on how many attempts were taken, how much tests varied between attempts, and similarities with other tests. While a pre-test followed by post-test is a traditional method for evaluating an intervention, such validity questions show how test scores need to be interpreted in their context and do not themselves directly represent mathematical achievement. A simple follow-up study 6 months later, for example, could greatly enhance the validity of this study or launch a new study.

The WRAT 4 test also needed to be translated, so the accuracy and meaningfulness of questions had to be re-asserted by using a pilot study, checking with colleagues, and checking the back-translation with the original test publishers. This thorough preparation of the WRAT 4 instrument therefore supports claims to reliability and validity based on previous studies of the tool in English, but the fact that this is the first study using the test in Arabic means that further evaluation will also be necessary in future studies.

Translation of the student attitude questionnaire was not an issue since this was a custom-made tool, but the associated downside is that there are no previous studies supporting the reliability or validity of the tool. However, some items were adapted from earlier studies and so benefitted from the rigour of those studies in designing good question items to evaluate student attitudes. Items were updated, added or omitted relevant to the study context, further adding to the validity of the tool.

The Knowledge of Peer Tutoring tool was similarly carefully prepared with validity in mind, starting with a thorough review of the literature and going through a multi-stage process of checking drafts with colleagues, supervisors, and through a pilot study. Muijs (2004) describes such literature-based processes as important for improving both content and criterion validity, learning from how other researchers have

conceptualised the same topics. Beyond this, the focus groups and discussions with colleagues helped to consider the cultural dimension and how some items might need to be adapted to make sense in a Middle Eastern context.

As Given (2008) points out, reliability also needs to consider how data was analysed. Starting with well-defined research questions and a strong literature review are both therefore important for validity in this respect because they give clearer rationales for conducting analysis. The most significant risk, that of familywise errors (Field, 2009) from over-worked data, was further reduced by ensuring that all the analysis was reported in the findings chapter. Including reports of dead-ends or negative results is crucial for the overall trustworthiness of the study, helping to avoid the risk of cherry-picking data.

Being able to know which student completed each response on both WRAT-4 Maths tests and the attitudinal questionnaires also meant that pre-test and post-test comparisons could be made at the individual level as well as the group level. This greatly enhanced the validity of analysis since it allowed greater control over how individual variance was treated. However, there may also be a limitation in that this did not allow total anonymity of responses. While it is highly unlikely that a lack of anonymity impacted on the WRAT-4 Maths test scores, it is conceivable that students may have responded differently to the attitude questionnaire if their responses had been anonymous. For example, it might be expected that students would give higher enjoyment ratings when they have got to know a new teacher and know that they will be able to see their ratings, although such effects should be similar between the intervention and control groups and so are controlled for in the study design.

Research question 5 requires applying qualitative standards of reliability since its analysis of the perceptions of trainee teachers broadly considered their views of the intervention strategy itself (i.e. Maths PALS), how it had been implemented (including evaluating the effectiveness of their own training at university), and their assessment of student outcomes with respect to both academic and social goals. None of these aspects of the research question sought to quantify responses or apply a numerical scale to summarise responses, although there was some counting of responses. There is some tension regarding this in the literature, with Pyett arguing that “counting responses misses the point of qualitative research” (Pyett, 2003, p.1174),

while Plowright (2011) is more forgiving and simply recommends that the analysis approach should be consistent with the research question.

Finally, social outcomes were found to be much more important to the teachers than first anticipated. Given this, it would have been helpful to know how students felt about group interactions. This is a recommended part of some peer-tutoring implementations so that students can be supported to reflect on their group-working skills (Topping et al., 2017), so would have been a useful addition to add students' perspectives as well as those of their teachers.

5.22 Prospects for future research and development in teacher training

Encouraging wider adoption of PALS in Saudi Arabia will require being clear on just what PALS can do for a group. There is a strong case to be made in Saudi Arabia for PALS focusing on social skills and affective improvements. Such benefits have been consistently recognised as emerging from peer-tutoring interventions, but tend to be thought of as "added value" rather than valuable ends in themselves (Topping, 2005, p.635). However, affective gains and social skills will be important considerations as the education system increasingly moves towards an inclusion model, integrating students with special educational needs who have previously either studied in special schools or in separate classes within standard schools (Kingdom of Saudi Arabia Ministry of Education, 2017). Latest figures suggest that, for the first time in the Kingdom's history, the number of students with special educational needs attending mainstream schools now outnumbers students with SEN who attend special schools (Al-mousa, 2010), although the caveat mentioned above that this is often within separate classes should be remembered.

However, it may be difficult for PALS to gain traction if it is unable to produce the same or better examination outcomes as current practices or if advocates of PALS have to use complex statistical manipulations to be able to demonstrate progress. Even with potentially lower performance gains, there are still several arguments in support of PALS. First is that this study showed strong attitudinal and skills-based development, which over the longer-term may translate into improved exam scores. Additionally, it seems that similar studies of students with SEN tend to report smaller effect sizes anyway (Ginsburg-Block et al., 2006), so it may simply be that expectations of performance gains need to be more carefully managed.

Alternatively, it could be argued that these social and affective outcomes are worthwhile in their own right irrespective of their relationship to exam scores. There is growing support for the concept of emotional intelligence (Radford, 2003), highlighting the importance of developing soft skills as well as content knowledge. Such a view would be highly compatible with the aims of Saudi Arabia's Vision 2030 for a diversified and internationalised workforce ready to meet the challenges of globalisation (Kingdom of Saudi Arabia Ministry of Education, 2017). Taking this argument further, it may be timely for Saudi Arabia to consider the validity of its examinations. As Stobart points out, outcomes can lose their reliability when too much emphasis is placed on them and so exams require regular updating to prevent over-emphasising a narrow set of skills (Stobart, 2008).

New tests which assess problem-solving abilities might be more meaningful for the direction in which Saudi Arabia wants its education to go, and the closer alignment with the aims of PALS might enable studies to demonstrate how PALS is a suitable strategy for these more complex outcomes. However, care will need to be taken to avoid the temptation to cherry-pick those tests which show PALS in the best light.

As mentioned in the contributions to knowledge section, the emphasis on social skills and collaborative problem-solving suggests that these teachers might usefully apply collaborative assessment strategies as part of their formative assessment approach in support of PALS. For example, Crouch and Mazur (2001) give an example of group assessment helping university students to generate feedback and instruct each other as part of their assessment. Mazur shows an example of assessment at Harvard in which students complete their test papers individually as normal, but this only counts for a portion (in Mazur's example, 80%) of their grade. After completing their test individually, students are given the same test paper but work in groups. This encourages students to share ideas and explain how they worked out answers, working on the principle that it should be easier to convince peers of a correct answer than an incorrect answer. This creates immediate peer feedback, which is both highly valuable and is subject to immediate critical evaluation by the group as they work towards a common goal. As a side benefit, the teacher will find that they will only need to provide feedback on tasks which confused the entire group. After agreeing their answers, the group score adds the remaining 20% to each individual's grade.

This type of assessment blurs the distinction between assessment *of* learning and assessment *for* learning, creating a synthesis in which students continually develop

with assessment *as* learning (Falchikov & Boud, 2007). The approach to peer instruction also seems highly compatible with how PALS worked in this intervention study, helping students to identify not just areas they need to work on but also where their strategies may be flawed.

Future research might also wish to look at the impact of fidelity checking and research assistant support on interventions. It might be assumed that the more help is available, the better the intervention performs. However, this study suggests that mathematics progress might be reduced by this extra involvement, a finding echoed in Stein et al.'s (2008) study of PALS in reading. This study suggests that teachers value being given well-organised resources which are ready to be used without the need for further differentiation or adaptation. Future studies might therefore be able to compare how resources are used by students to conduct a less intrusive fidelity check. The same trainee teachers used in this study might also be valuable as researchers in the future to allow a more natural intervention.

In developing tools for teacher training in PALS, it might be worthwhile considering how teachers will self-monitor their fidelity. Creating a new tool based around principles rather than instructions could be helpful, or follow-up training for teachers could even ask them to design their own self-evaluation resources as a way of reflecting on any adaptations they have made. Similarly, future research might helpfully look into whether PALS remains distinct in the longer-term from other peer-learning approaches. The discussion in section 1.18 argued that PALS may be a helpful introduction to other peer-learning approaches, so it will be helpful to see how teachers develop their own practices and how much importance they place on staying true to the specifics of PALS as they come to learn more about peer-learning principles.

With an emphasis on quantifiable improvements in performance, it is easy to overlook the importance of affective and social benefits from peer-tutoring. The focus within PALS on specific skills remedied in a short time-span similarly implies that the intervention has improvement in mathematical skill as its primary aim. It has previously been argued that peer tutoring sees social development as "added value" (Topping, 2005, p.635). However, it may be more appropriate to consider the goals as equal within peer *learning* made up of "two objectives, one regarding academic learning and the other regarding social objectives" (Topping, Buchs, Duran, & Van Keer, 2017, p.51). Future developments might therefore consider whether students

in Saudi Arabia should focus on both goals. If so, PALS may be less helpful than other peer learning approaches and might be more helpful, at least initially, in more closed settings such as nurture groups.

As with any small-scale study, the encouraging findings in this study suggest that there would be value in larger-scale studies addressing similar research questions. Given that PALS has proven so popular among these trainee teachers, a future study could randomise among a larger group of trainee teachers to provide PALS training. Self-evaluation over a longer period (e.g. a year) would then be able to look at how well trainee teachers kept to the PALS structure without the reinforcement effect of regular fidelity observations.

As discussed in the section on validity of the WRAT-4 Maths subtest, future studies could also more rigorously control for any effects from test familiarity. For example, tests with which students are already familiar could be used or the tests could be introduced well in advance of any intervention. Comparisons of different types of test might also show if some tests are more immediately accessible than others, helping to minimise any distorting effects arising from familiarity with question type or test format.

The improvements in trainee knowledge during their training were impressive and substantial, though not complete. However, improvements in fidelity compared favourably to similar previous studies and suggested that the materials given to these trainees were effective in supporting their ongoing development and improving their knowledge of peer-tutoring through self-study. A follow-up test of knowledge gains at the end of the intervention would be helpful to see how effectively such self-study was in terms of trainee teachers' overall knowledge of peer-tutoring, rather than just improvements in their practical skill of implementing the guidelines with a higher degree of fidelity. Such a follow-up study would be a relatively straightforward addition to future evaluation studies, but could yield very valuable information on how training in PALS could be designed to get the best balance between front-loading of training, providing self-study materials, and if follow-up or refresher training is needed.

5.23 Warranted assertability of findings for each research question

Plowright's (2011) standard of warranted assertability requires that the findings and discussion are able to make stronger claims than would have been possible from the

existing literature. Given that there was so little research in a Middle Eastern context, this is a relatively simple condition to satisfy. Nevertheless, it is helpful after such an in-depth discussion to consider how discussion has progressed in each research question as this study has developed.

5.23.1 RQ1: What gains in knowledge are evident from the trainee teachers of SEN children who have undertaken a preparatory peer tutoring course?

Studies reporting difficulties in training teachers to use peer-tutoring approaches are rare, with the main difficulty arising from conflict with teachers' preconceived notions of learning. As Topping (2005) points out, however, peer-tutoring can be applied in such different ways that this should rarely present a problem for training providers. This study adds that the training can be effective for trainee teachers in a Middle East setting, challenging the expectation that the region is wedded to traditional didactic approaches.

5.23.2 RQ2: To what extent do trainee teachers of SEN children implement peer tutoring programmes (Maths PALS) according to expected guidelines in the teaching practice?

Observation data showed fidelity very similar to that already shown in the existing literature for fidelity achieved by fully-qualified teachers. This study therefore adds that trainees can achieve similar fidelity, as well as demonstrating that such approaches can be successfully maintained in the Saudi Arabian classroom, albeit with slightly more time seemingly required for preparing students at the start of the intervention.

5.23.3 RQ3: To what extent does engaging in the peer tutoring programme (Maths PALS) result in improvements in mathematics for pupils with intellectual disabilities?

The current literature is divided on the impact of PALS on academic progress, with moderate overall effect sizes and smaller effect sizes noted for younger students and those students with SEN. Limited academic progress might therefore have been expected in this study, and this seems to be confirmed with the WRAT 4 analysis of percentage gains (rather than raw score gains). The age-adjusted figures suggest that improvements may be slightly larger than expected in the literature, but this can also be partly explained by female-only composition of the classes since female students are generally found to be more receptive to peer-tutoring.

5.23.4 RQ4: To what extent does engaging in the peer tutoring programme (Maths PALS) result in positive changes in attitude pupils who have intellectual disabilities towards mathematics?

Attitudinal and social outcomes have only recently started to be emphasised in the literature, with this study adding support to arguments that the most significant contribution of PALS might be to social rather than attainment outcomes. In the context of the challenging inclusion environment in Saudi Arabia, this claim adds support for PALS being used explicitly for social development in much the same way as Jigsaw peer-tutoring approaches and nurture group pedagogy has developed around these goals.

5.23.5 RQ5: What perception do trainee teachers have of the peer tutoring programme (Maths PALS), its implementation and the outcomes for pupils and themselves?

The enthusiasm for PALS was far higher than might have been expected, with the trainee teachers praising PALS for transforming the learning experience for their students as well as teachers' own views of teaching. In the context of concerns in the existing literature that Saudi Arabia lags behind its international peers and will struggle to modernise its pedagogy, such enthusiasm indicates that trainee teachers can be a powerful force for change and are very receptive to anything that can enhance learning for their students.

5.24 Final comments

This study set out to look at the different ways PALS might influence learning in a setting where it had not previously been considered, namely a female-only special education classroom in Saudi Arabia. There already exists substantial literature showing that PALS is effective across a range of curriculum areas, student age groups, for students with special educational needs, and largely irrespective of a teacher's beliefs being constructivist or not. However, it also appeared that PALS was less effective for younger students and those with SEN or where teachers did not implement the approach with enough fidelity. With only moderate effect sizes shown for PALS in general anyway, there was every reason to expect that the impact of PALS could have been negligible for these students. Added to this was the risk of an entirely novel approach. Nevertheless, it was clear that Saudi Arabia's Ministry of

Education was keen to modernise pedagogy and, as a teacher educator, such innovations needed to be explored.

Being a pioneer can be highly intimidating, especially in such a traditionally authoritarian culture as exists in Saudi Arabia. Peer learning can also be difficult to establish in schools whose ethos does not fit with these principles, stressing that "a school culture fostering collaboration among teachers is often reported as an important stimulating condition for successfully implementing peer learning" (Topping, Buchs, Duran, & Van Keer, 2017, p.163). The trainee teachers in this study rose to the challenge admirably. Lacking expert colleagues to use as role models, these trainees made excellent use of training materials to engage with the principles of PALS and deliver some inspirational experiences for their students. Indeed, in some cases they seemed to inspire colleagues to try PALS for themselves, showing that trainee teachers can be instrumental in fostering a culture of collaboration among teaching staff.

The substantial progress made by these trainees in how they came to conceptualise their role as teachers was an unexpected bonus and, combined with the social progress made by their students and the greater sense of purpose in classrooms, it seems hardly to matter that students' performance in tests may arguably not have improved much more than it would have done had they been taught using traditional approaches. Clearly more research is needed to see how this would develop in the longer-term and if improvements in enjoyment or classroom climate would eventually result in improved test performance. However, these is also an argument to be made that modernising pedagogy in Saudi Arabia should be accompanied with modernising its assessment regime. The enthusiasm with which teachers in this study spoke of social improvements suggests that new assessments could usefully consider how to assess and reward the much-desired soft skills of cooperation and supportive inter-dependence.

Finally, there are useful lessons for teacher education emerging from this study. Trainee teachers appear to be highly receptive to more student-centred approaches, and can implement them with a higher level of skill than might be expected. Teaching using PALS seems to have developed these teachers' understanding of learning more quickly than has been achieved in lectures at university, so introducing trainees to PALS while they are students might prove extremely valuable in challenging pre-conceived notions that teachers need to be the sole repository of knowledge.

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Appendix 1: Timeframe for Administration of Training and Measurement

Date	Administration/Training
September 2015	10 Teacher were trained on how to administer: • WRAT- 4 Maths subtest (Blue, Green Form) • Attitudinal Questionnaire to learning maths
September 2015	Pretest about PT were administered to 5 Teachers (who formed PALS group). Training session were administered to introduce Peer Tutoring to the PALS trainee teachers.
September 2015	Training workshop were administered to train PALS teachers on Maths PALS programme: Posttest about PT were administered to PALS teachers two week after the training course
September 2015	Training workshop about PALS were conducted to the visiting tutors & research assistants. They were trained on how to administer: • Observation Checklist • WRAT- 4 Maths subtest • Attitudinal Questionnaire to learning maths
September 2015	Prior the intervention, pretests were administered to pupils on both sets (experimental/control) by teachers on*:* • WRAT 4 Maths subtest **(Blue form)** • Attitudinal Questionnaire to learning maths
October- December 2016	PALS / non PALS teachers administered intervention over 12 week study: • Conventional methods + PALS programme for experimental group • Conventional methods for control group
January 2016	One week after completion of study, posttests were administered to pupils On both sets (experimental/control) by research assistants: • WRAT 4 Maths subtest **(Green Form**) • Attitudinal Questionnaire to learning maths By researcher: • Interviews were conducted with PALS trainee teachers • Training workshop were administered to train non PALS teachers

Appendix 2: Reference to Maths PALS Manual

PEER ASSISTED LEARNING STRATEGIES

First Grade Math PALS

TEACHER MANUAL

2011 Revised Edition*

Lynn S. Fuchs, Douglas Fuchs,
Laura Yazdian, Sarah Powell, & Kathy Karns

Contributors to the 2011 Revised Edition:
Lauren Deason
Beth Perkins
Amanda Reece

For more information contact:

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Email: pals@vanderbilt.edu

Phone: (615) 343-4182

***The content of the 2011 Revised Edition has not changed from the original edition of Math PALS**

Appendix 3: Example of Maths PALS Materials (Arabic Version)

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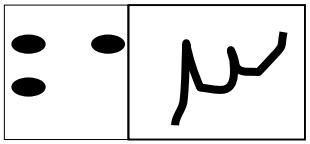

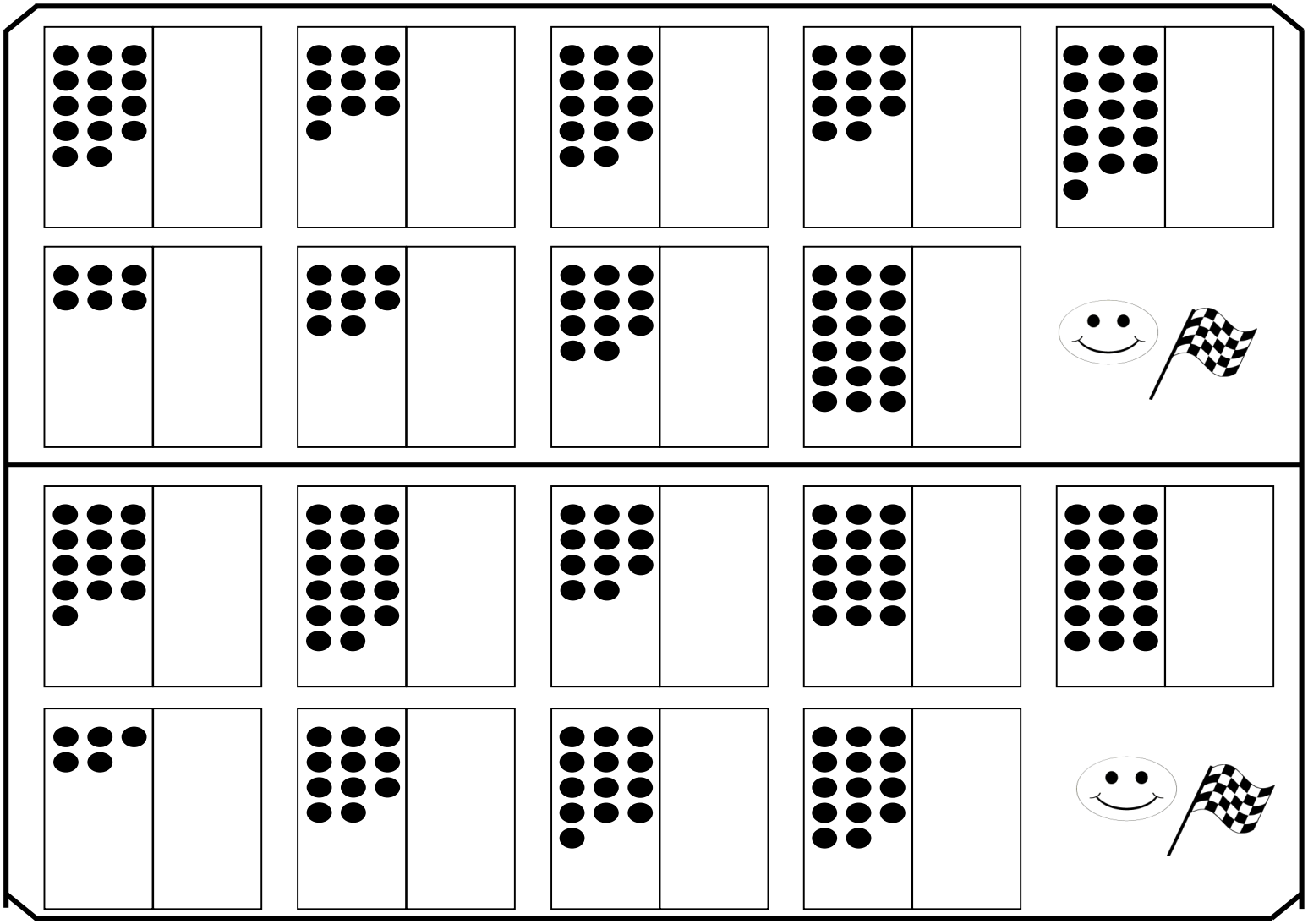

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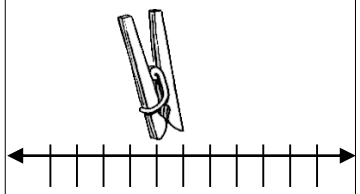

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ماهو العدد؟

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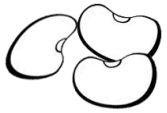

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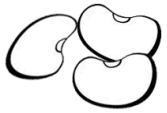

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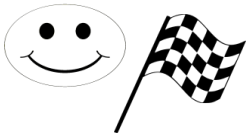

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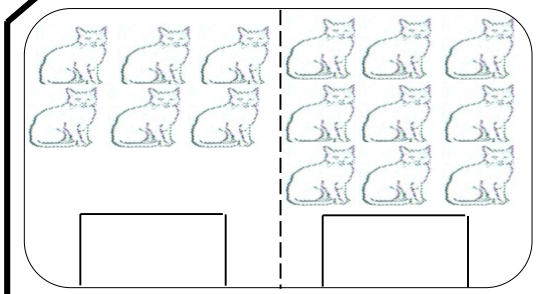

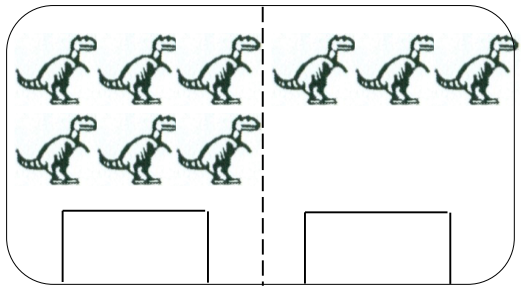

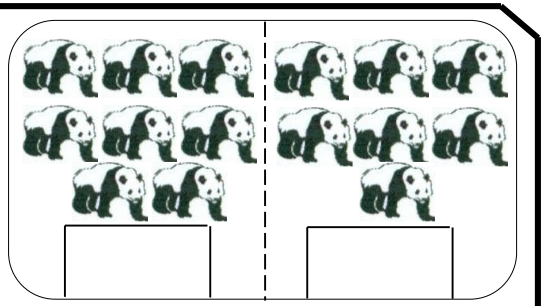

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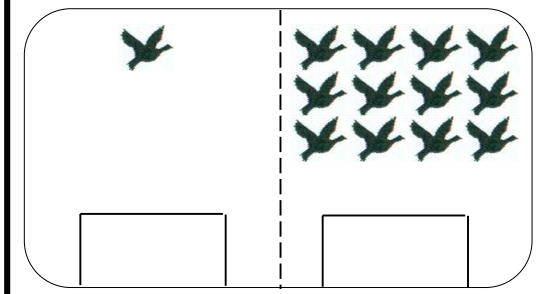

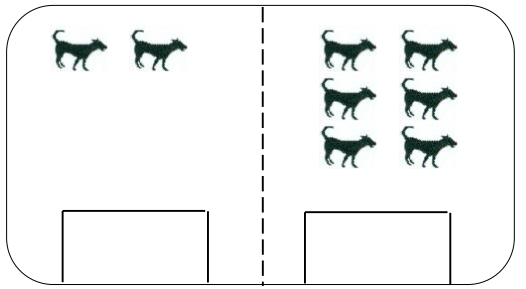

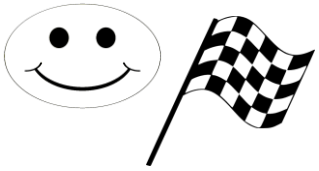

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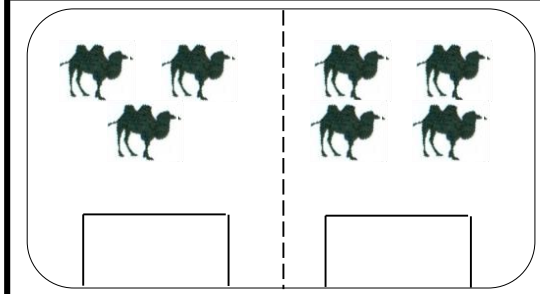

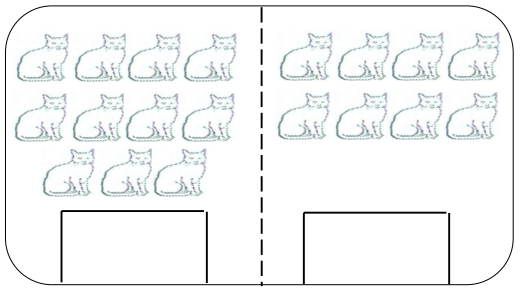

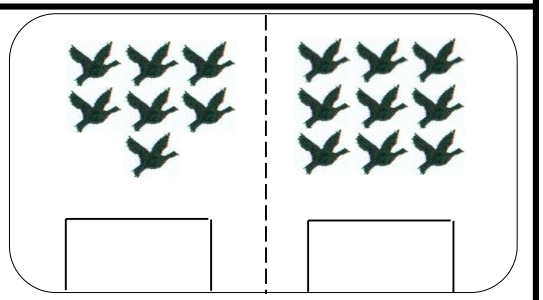

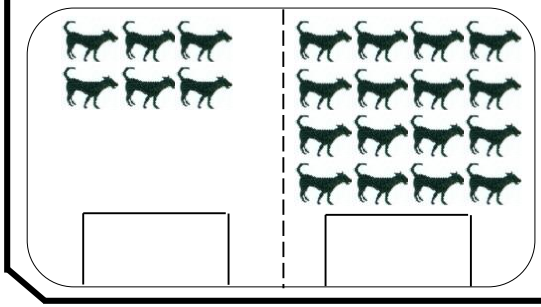

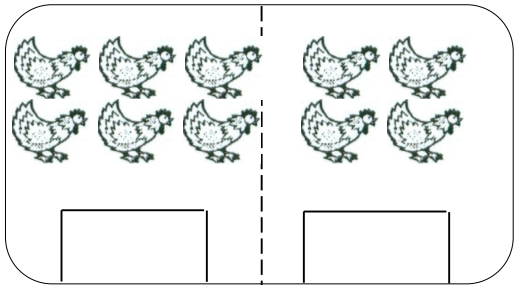

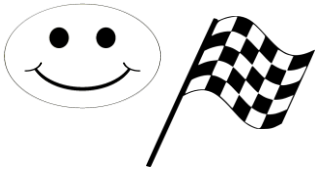

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Appendix 4: Teacher Training

Teacher Training Session Plan

Title: Introductory course in Peer Tutoring

length: 3 hours

Aim

The overall aim of this session is to provide trainee teachers with a comprehensive, introductory overview of Peer Tutoring teaching method.

Objectives

By the end of this session, participants will be familiar with:

- Definitions of Peer Tutoring
- Types and forms of Peer Tutoring
- Some of the major theoretical underpinnings of Peer Tutoring
- Some of research in terms of practical implementation of Peer Tutoring
- Educational and social advantages of Peer Tutoring
- Potential disadvantages of Peer Tutoring and some of problematic issues to implement it successfully

Learning Outcomes

Upon successful completion of this course, participants will be able to:

- Demonstrate knowledge of the fundamental principles and concept of Peer Tutoring
- Distinguish between various forms of Peer Learning
- Demonstrate awareness of the main theoretical principles that underpin Peer Tutoring
- Demonstrate general awareness of the research that underpins Peer Tutoring
- Demonstrate awareness of the potential advantages and disadvantages of Peer Tutoring

Materials

- Copies of the “knowledge base” (handout) for each participant
- Sample session plan for each participant
- PowerPoint slide handout for the session for each participant
- Smart Board. Power Point presentation
- Flip chart and markers
- Visual aids

Teaching Strategies

- Active learning strategies
- Small group activity (4 participants)
- Pair**s** activity
- Class discussion

- Constructive feedback

Assessment

- Pre-test Post-test of knowledge about Peer Tutoring.
- Presentation's feedback form (participants will be asked to take 2 minutes to complete the anonymous forms in order to get their feedback about the presentation)
- My reflection (I will report what I have Learned from my training experience, what I think was the greatest learning achievement as a result of the session, provide justification or evidence to support my statement; provide suggestion that I might have for future training session and my highlights to better prepare others).

  The researcher's contact:
  XXX@exeter.ac.uk

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered* .	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required ?*	What are participants doing? *Do, Reflect, Generalize, Apply*
Starting the presentation	Slide 1: The title The facilitator will introduce herself and the topic of the presentation	Power point slide Leaflet	2 min	
Students' knowledge of Peer Tutoring will be assessing	The facilitator will distribute pre-test papers among the students	Pre- test of knowledge about peer tutoring	10 min	Students will answer the test
Presentation Overview	Slide 2: The facilitator will emphasize the key points that she is going to talk about.	power point slide	2 min	
Making connections between what they have already know and what they will know	Slide 3: activity 1 A question will have posed: Think of what you know about Peer Tutoring?	" Opening question" on PowerPoint slide	5 min	Taking a moment to reflect on their experience with power point. Coming up with answers

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required ?*	What are participants doing? *Do, Reflect, Generalize, Apply*
Comparing between cooperative learning and peer tutoring	Slide 4: Videos The facilitator will display 2 videos about Cooperative learning and Peer tutoring	Video (1) Cooperative learning (0:49 Sec.) http://www.youtube.com/watch?v=2G46ahbLsIw Video(2) peer tutoring (2:38) http://www.youtube.com/watch?v=kanRyTRI8xM	3 min	
Trying to find out the definition of Peer Tutoring	Activity 2 A question will have posed: Think of what a sort of comparison between the two videos? Do you have anything to share with the class?	PowerPoint slide	15 min	First, turning to their partner and sharing their knowledge. Second, sharing their thoughts with the class.

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required ?*	What are participants doing? *Do, Reflect, Generalize, Apply*
The concept of Peer Tutoring	Slide 5: Definition The facilitator will emphasize the fundamental principle of PT. This include an explanation for the differences between the 2 video - it is good practice to end each activity with a statement of what you want them to take away(understand) from the activity	Power point Slide	5min	
Distinguish the difference between each forms of PT	Slide 6: The facilitator will explain the variety forms of PeerTutoring	Power point slide	10 min	
Coffee Break			20min	

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required ?*	What are participants doing? *Do, Reflect, Generalize, Apply*
Theoretical principles of PT	Slides 7 & 8: The facilitator will provide a brief description of relevant learning theories.	Power point slide	15 min	
Some of research in terms of practical implementation of PT	Slide10: evidence concerning the effectiveness of tutoring will be examined relationship between the different tutoring styles can be located	Power point slide	15 min	
The ability to evaluate the advantages and disadvantages of PT	Slide 11: Activity 3 Participant will be asked the following question: List as many advantages and disadvantages of Peer Tutoring as you can?	Big sheets of paper and markers	20 min	" Brainstorming," 10 min: in small group, students will think and write what they know by forming connections between prior knowledge and new possibilities. 10 min: each group will share their information with a whole class

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required ?*	What are participants doing? *Do, Reflect, Generalize, Apply*
Some knowledge of the benefits of Peer Tutoring	Slide 12: The facilitator will present some studies to explain wide range of benefits of PT	Power point slide	10 min	
Some knowledge of problematic issues	Slide 13,14 &15: The facilitator will justify some potential problems to implement PT successfully	Power point slide	10 min	
Summarizing key point about Peer Tutoring and locating misconception	Slide 16: Activity 4 The facilitator will ask students to take a few minutes to compare notes with a partner and answer the following question: • Summarize the most important information • Identify any sticking points	Sheets of paper and markers PowerPoint slide	10 min	Students will work together and reflect on what they have learned to: -Summarize the key points of the presentation in their own words. -Identify gaps in their understanding of the knowledge.

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required ?*	What are participants doing? *Do, Reflect, Generalize, Apply*
-Helping facilitator to judge how well students are learning the material and what the facilitator needs to spend more time on.	Slide 17: Activity 5 " A minute paper" If you could ask one last question..... *What would it be?*	PowerPoint slide Sheets of paper and markers	15 min	Students will work in pairs and think deeply about the material before leave the room and come up with a final good question Questions will be shared and answered in the class
Conclusion	Slide 18: The facilitator will: -Consider ending her presentation by taking the audience back to the key points. -Thank the audience for their attendance.	PowerPoint slide	3 min	

Teacher Training Workshop Plan

Title: Math Peer-Assisted Learning Strategies (Maths PALS)

Time: 3 hours

Workshop Aim

The overall aim of the workshop is to enable trainee teachers to competently implement Math PALS (Peer Assisted Learning Strategies) in their teaching practice placement.

Workshop Objectives

By the end of this workshop, participants will be familiar with:

- Maths PALS manual and materials
- Maths PALS features
- PALS procedures given by teacher (Teacher behaviour)
- PALS procedures for pair work (Students behaviour)
- Assistance given by teacher and monitoring
- Students pairing
- Students training
- Implementing Maths PALS

Learning Outcomes

Upon successful completion of this course, participants will be able to:

- Use Maths PALS materials
- Implementing Maths PALS independently with their students.
- Pairing students
- Training students to work effectively in pairs
- Monitor PALS pairs throughout the class.

Materials

- Leaflet
- PALS Math teacher manual, PALS folders, materials and PA:LS rules posters
- PowerPoint slide handout for the session for each participant
- Computer and Smart Board. Power Point presentation
- Flip chart and markers,

Teaching Strategies

- Interactive lecture
- Group Activity
- Pair work
- Class discussion
- Role –Play
- Constructive feedback

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required?*	What are participants doing? *Do, Reflect, Generalize, Apply*
Assessing Students' knowledge of Peer Tutoring	The facilitator will distribute pre-test papers	Post- test knowledge of peer tutoring	10 min	Students will answer the questionnaire
Starting the presentation	Slide 1: The title The facilitator will welcome the participants, distribute the materials among students and introduce the topic of the workshop	Power point slide Leaflet, Maths PALS manual, PALS folders and materials	2 min	
Overview of the presentation	Slide 2: The facilitator will present the main points which will be discussed.	The following key points will have displayed on a Power Point slide: • Maths PALS manual and materials • Maths PALS features • PALS procedures given by teacher (Teacher behaviour) • PALS procedures for pair work (Students behaviour) • Assistance given by teacher and monitoring • Students pairing • Students training • Implementing Maths PALS	2 min	

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required?*	What are participants doing? *Do, Reflect, Generalize, Apply*
To get participants talking and encourage them to assimilate new information by building on their existing knowledge	Slide3: PALS The facilitator will say " Two weeks ago we talked about Peer Tutoring, we mentioned PALS " Think of what do you remember about PALS?	PowerPoint slide	5 min	pairs will respond and share their thought about PALS
present Maths PALS manual and materials	Slide 4,5,6,7 & 8 The facilitator will provide information about the content of PALS manual and how to use it	PowerPoint slide PALS manual	7 min	
To illustrate PALS features and procedures	Slide 9, 10 & 11 PALS features: PALS procedures given by teacher. PALS procedure implementing by students. Assistance giving by teacher.	PowerPoint slide Sample of the " Game board" Sample of " Smiley sheet"	10 min	

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required?*	What are participants doing? *Do, Reflect, Generalize, Apply*
To recognise mathematics skills for Kindergarten to Grade 3	Slide 12: The facilitator will provide a brief description of Math skills for each grade		2 min	
Student pairing	Slide 13 The facilitator will explain how to pair each student with a partner	Power point slide	6 min	
Illustrate PALS pair work	Slide 14 Participant will be asked to observe the video and use the checklist to place a checkmark for each PALS feature will be identified	2 Videos about Maths PALS implementing in class PALS observation checklist Power point slide: Game Board Example on " Number Concepts"	15 min	Discuss and share their comments about the video

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required?*	What are participants doing? *Do, Reflect, Generalize, Apply*
Demonstrate the role of Tutor and the role of Tutee	Slides 15 and 16 The facilitator will pretend the role of the " Tutor" and ask the participants to take the role of the Tutee	Power point slide: Game Board Example: Number concepts	5 min	Participants will engage in interacting with the facilitator
Practise Game Board with the facilitator	Slides 17,18,19: The facilitator will ask for volunteer to work with her on pair to show the PALS procedures for Pair work (students behaviours)	Power point slides: Game Board Example on "deciding which is more or less using pictures"	6 min	The volunteer will take the role of "Tutee" and the facilitator will take the role of "Tutor" and then they will exchange the role.
Participants practise Game Boards in pairs	Activity Slides 20, Participant will be asked to practise PALS procedures. The facilitator will take the role of teacher, Provide PALS procedures, provide feedback when necessary, encourage and provide reward for good pair work	PALS folders, Game Boards, Smiley sheet Example on " Addition using pictures' Example on " one-digit subtraction" Example on " Place value " Example on "Single digit addition and subtraction" Example on" Double digit addition and subtraction" Example on " Missing Addendum"	15 min	The participants will be asked to pretend the role of tutor and the role of tutee and work in pairs

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required?*	What are participants doing? *Do, Reflect, Generalize, Apply*
Coffee Break			20 min	
Day 1 of every new Math skill	Slides 23,24 The facilitator explain the process to run the first day of every new math skill	Slides on power point	5 min	
How to train students on Maths PALS	Slide: 25,26 The facilitator will explain the process and the steps to train students on PALS The participant will be asked to work in pairs and think of different ways to introduce PALS to SEN children	Slides on power point	15 min	Each pair of participant will use a big sheet of paper to write several ways to introduce PALS to SEN children. Participants will exchange written sheets with others to share feedback
Practice implementing PALS in class	Slide 27: Lets practice Each participant will be asked each time to pretend teacher role, tutor role, tutee role and observer role to practice implementing PALS in classroom.	PALS folders, Game Board and Smiley sheet PALS implementing checklist	30 min	The participants will take turns as tutor, tutee, teacher and observer Each participant will get feedback from her colleagues

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	Phase *Description for each part of presentation and activity that we plan to run in this training session.*	Materials *What do we need to run the presentation or the activity?*	Time *How much time is required?*	What are participants doing? *Do, Reflect, Generalize, Apply*
Wrap Up	Slides: 51,52& 53 The facilitator will summarize the most important information and thank the participants for their attention	Power point slides	5 min	
Open discussion	The facilitator ask participant if they have any comment or want to ask any question or discuss and share their thoughts		20 min	Participants will have opportunity to pose a questions, identify any sticking points and discuss anything about PALS.

Appendix 5: Visiting Tutors and Research Assistants Training

Workshop plan

Title: Math Peer-Assisted Learning Strategies (Math PALS)

Time: An hour and half

Workshop Aim

The overall aim of the workshop is to enable visiting tutors to support and monitor the administration instructions of Math PALS programme (Peer Assisted Learning Strategies) in teaching practice placement.

Workshop Objectives

By the end of this workshop, participants will be familiar with:

- Math PALS
- Math PALS material
- Implementing Maths PALS
- Pairing students
- Training students
- Checklist observation of implementing PALS
- Observer consistency and inter-observer agreement
- How to support trainee teachers in their efforts to implement Math PALS programme

Learning Outcomes

Upon successful completion of this course, participants will be able to:

- Support trainee teachers in their efforts to implement Math PALS programme
- Use checklist observation forms during Math PALS session
- reach up to 90% in inter- observer agreement
- Monitor Math PALS sessions throughout teaching practice placement

Materials

- Leaflet about " How to implement Math PALS "
- PALS Maths manual
- Sample materials
- Checklist forms
- videos about PALS
- leaflet
- Computer and Smart Board. Power Point presentation
- Flip chart and markers

Teaching Strategies

- Interactive lecture
- Group Activity: in pairs
- Class discussion
- Role –Playing
- Constructive feedback

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	**Phase** *Description for each part of presentation and activity that we plan to run in this training session.*	**Materials** *What do we need to run the presentation or the activity?*	**Time** *How much time is required?*	**What are participants doing?** *Do, Reflect, Generalize, Apply*
A positive start of the presentation	Slide 1: The title The facilitator will welcome the participants and distribute the leaflet to them and introduce the topic of the workshop	Power point slide	1 min	
Overview of workshop	Slide 2: Workshop overview The facilitator will present the main points which will be discussed	The key points will be displayed on a Power Point slide	1 min	
To grab participants' attention to the topic 	Slide3: What is PALS? The facilitator will show a video (1:13) http://www.youtube.com/watch?v=IvxSr3D2n48 Think of what is PALS?	PowerPoint slide	4 min	More than one student has an opportunity to respond and share their thought about what they have watched

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	**Phase** *Description for each part of presentation and activity that we plan to run in this training session.*	**Materials** *What do we need to run the presentation or the activity?*	**Time** *How much time is required?*	**What are participants doing?** *Do, Reflect, Generalize, Apply*
What Maths PALS and its features	Slides 4, 5, 6, 7, 8 The facilitator will talk about PALS and illustrate: PALS features: • PALS procedures given by teacher • PALS procedure implementing by students • Assistance giving by teacher	PowerPoint slide	5 min	
How to use Math PALS manual?	Slide 9, 10 , 11 & 12 The facilitator will: • provide information about the content of PALS manual • Provide basic idea on how to use the manual • Explain how to use Game Boards		5 min	
How to implement maths PALS in pair work	Slides: 13, 14 The facilitator will demonstrate the role of (tutor) and ask the participants to pretend role of (tutee).	Power point slides: Example Sample of the " Game board" Sample of " Smiley sheet	5 min	Participants will actively engage in interacting with the facilitator
Practise Game Board with the facilitator	Slide 15 The facilitator will ask for volunteer to practice Game Board	Power point slides: Example Sample of the " Game board" Sample of " Smiley sheet	5 min	The volunteer will take the role of "Tutor " and the facilitator will take the role of "Tutee" and then they will exchange the role.

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	**Phase** *Description for each part of presentation and activity that we plan to run in this training session.*	**Materials** *What do we need to run the presentation or the activity?*	**Time** *How much time is required?*	**What are participants doing?** *Do, Reflect, Generalize, Apply*
Participants practise Game Boards in pairs	Activity Slide 16 The participants will be asked to work in pairs and pretend the roles of tutor and tutee and implement PALS procedures. The facilitator will take the role of teacher, Provide PALS procedures, provide feedback when necessary, encourage and provide reward for good pair work	Example of Maths PALS material on Addition and subtraction	6 min	The participants will work in pair and practice the material
Student pairing	Slides 17,18,19 Facilitator explain how to pair students in class	Slides on power point	4 min	
Checklist schedule of Maths PALS implementation	Slide 20 The checklist divided PALS features into three components The checklist described the fidelity of implementing PALS for teacher and students	Power point slide Checklist schedule	8 min	

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	**Phase** *Description for each part of presentation and activity that we plan to run in this training session.*	**Materials** *What do we need to run the presentation or the activity?*	**Time** *How much time is required?*	**What are participants doing?** *Do, Reflect, Generalize, Apply*
Observer consistency and inter-observers agreement	Slide 21: Activity Participant will be asked to observe the videos and use the checklist to place a checkmark for each PALS feature will be identified	PALS videos will be presented	15	Each observer will check her consistency by obtain the same results when observing the same behaviour on different videos Inter observer agreement will be developed by observing videos, discussion and sharing feedback
Training on using checklist forms	Slide 22 The participant will be asked to pretend the role of (the observer, tutor and tutee)	the observation checklist forms and Math PALS materials	15 min	They will work together and will use PALS materials and observation schedule. each participant will have a chance to play the role of observer, tutor and tutee
Pilot the checklist schedule	Slide 23 The participant will be asked to give their feedback and comments about the observation checklist		10 min	Participants will shared their feedback on the observation shedule

Element, Goal(s) &/or Indicator(s) *Element(s), goal(s) and/or indicator(s) are covered*	**Phase** *Description for each part of presentation and activity that we plan to run in this training session.*	**Materials** *What do we need to run the presentation or the activity?*	**Time** *How much time is required?*	**What are participants doing?** *Do, Reflect, Generalize, Apply*
brainstorming activity	Slide 24 The facilitator will ask the participants to : Think of all challenges that your trainees might face with PALS programme and you will face with observation? Depending on your situation, experience and knowledge, how do you deal with such challenges?		20 min	10 min: in small group, participants will think and write what they know by forming connections between prior knowledge and new possibilities. 5 min: each group will share their information with a whole class
Wrap Up	Slide: 25 The facilitator will summarize the most important information and thank the participants for their attention The facilitator ask participant if they have any comment or want to ask any question or discuss and share their thoughts	Power point slides	15 min	Participants will have opportunity to pose a questions, identify any sticking points and discuss and hear from everyone

Appendix 6 Knowledge Test on Peer Tutoring

Introduction to Test

Thank you for agreeing to participate in this research today. This data will be used to carry out an investigation into your knowledge of Peer Tutoring. The test has been designed to be quick and straightforward to fill out, and should take between five and ten minutes to complete. The tests are anonymous, and hence no personal information is required. Each test is numbered, and this number will be used to identify the responses, but not the individual who provided them. Please read each question carefully and consider your own opinions and views on the issue. It is important that the responses you provide are your own. The test is simply designed to build up a picture of a current knowledge on the subject of Peer Tutoring. In addition, please be aware that participation is entirely voluntary. If you are not comfortable with completing this test then you are free to decline. I am more than happy to answer any queries you may have at the email address provided below.

XXXX@exeter.ac.uk

A. Place a tick (✓) in the column to indicate your answer for each statement:

	Are the following statements true?	**Yes**	**No**	**Don't Know**
1	Peer Tutoring is an approach to learning that involves two pupils working together during the course of academic study to memorise information needed for assessments.			
2	Peer tutoring can be seen as a means through which pupils are able to supply support for each other, through engaging in activities in order to repeat what they have learned.			
3	Peer tutoring describes the process of social interaction which allows one individual to impart knowledge and/or skills to another.			
4	The role of tutors in peer tutoring can be seen to be helping tutees with the odd problem and acting in a purely supervisory role as and when they are needed.			
5	Peer tutoring is defined as " an acquisition of knowledge and skill through active helping and supporting among status or matched companions".			
6	PALS can be understood through the social interactionist view of cognitive development, which can be traced back at least as far as Vygotsky.			
7	Peer tutoring can be described as a process which stimulates cognitive growth as a result of sharing ideas with others through engaging in collaborative activities.			

	Are the following statements true?	Yes	No	Don't Know
8	It is not important that both individuals involved in peer tutoring, irrespective of their role, should gain similar amounts of benefit.			
9	Interaction between individuals within a peer group enables learners to grow intellectually as a result of them being able to create meaning and tackle problems.			
10	Peer tutoring enables individuals to become more aware of what they know, how they know it and why they know it			
11	On the PALS model , it is important to ensure that the more able students always play the role of tutor while the less able students play the role of tutee			
12	The effect of working with others disrupts children's patterns of thought which initiates cognitive development			
13	Evidence suggests that class wide peer tutoring is more effective than cross age peer tutoring			
14	Core skills are developed as a result of the immediate feedback that occurs as a result of the interaction between two individuals during the course of an activity			
15	Class wide peer tutoring is more suited to children who have moderate disabilities than Cross age tutoring			
16	Evidence states that some students may resist class peer tutoring on the basis that they are not comfortable with being tutored by classmates			

	Are the following statements true?	Yes	No	Don't Know
17	Class wide peer tutoring is logistically more challenging to implement than Cross age tutoring			
18	A key component of peer tutoring is the provision of immediate feedback on a person's work during the course of an activity			
19	Peer tutoring create a Zone of Proximal Development, similar to that which is created between siblings where the more experienced or knowledgeable individual assumes the role of the older child from whom the others can learn			
20	Research evidence suggests that the role reversal that occurs as a part of class tutoring is beneficial for the development of children's decision making skills			

B. **Tick only one or as many as apply:**

1- Cross age tutoring involves.....

a) Older children from the same class and peer group helping others
b) Older children from a different year group helping younger children with their learning
c) Children who are the same age tutoring each other.
d) Don't Know

2- " Peer tutoring has often proven to be far more problematic to implement successfully because of ....."

a) The high cost
b) The lack of training
c) Its time consuming

d) Don't Know

3- Peer Tutoring could affect ...

a) Academic achievement
b) Engagement levels
c) Peer bullying
d) Levels of learning
e) School dropout rates
f) Communication
g) Self-esteem
h) Motivation to learn
i) Don’t Know

4- Class wide peer tutoring involves :

a) reciprocal peer tutoring
b) inclusive practice
c) students from different classes
d) students who are of different ages tutoring each other
e) students at the same age
f) Don’t Know

5- The items that you believe to be correct in relation to Peer Assisted Learning Strategies (PALS) are:

a) It's a combined form of class wide peer tutoring (CWPT) and curriculum based measurement
b) It's a combined form of cross age peer tutoring and curriculum based measurement
c) It involves structured activities
d) It involves unstructured activities
e) It involves reciprocal roles
f) Don't Know

Thank you for completing this questionnaire

Knowledge Test on Peer Tutoring (Arabic Version)

اختبار المعرفة في مجال تدريس الأقران

مقدمة الاختبار

شكرا على موافقتك على المشاركة في هذا البحث اليوم. ستستخدم هذه البيانات لإجراء تحقيق في معرفتك بتدريس الأقران. وقد صُمّم الاختبار لكي يتسنى لك تعبئته بسرعة وبسهولة، وسوف يستغرق ما بين خمسة وعشرة دقائق للانتهاء منه. الاختبار سيكون مغفلا وبدون ذكر أسماء، وبالتالي ليس هناك حاجة إلى الإدلاء بمعلومات شخصية. كذلك سيتم ترقيم كل اختبار، وسيستخدم هذا الرقم لتحديد الردود، ولكن لتحديد الفرد الذي أدلى بها. يرجى قراءة كل سؤال بعناية وتيقن جيدا من آرائك ومواقفك بشأن هذه المسألة. من المهم أن تكون الإجابات التي تقدمها هي إجابات شخصية. لقد صمّم الاختبار ببساطة لتكوين فكرة حول المعرفة الحالية لموضوع تدريس الأقران. وبالإضافة إلى ذلك، نحيطكم علما العلم بأن المشاركة طوعية تماما. ولذا إذا كنت غير مرتاح أو مستعد للمشاركة في هذا الاختبار، فأنت حر في رفضه. يسعدني الإجابة عن أي استفسارات قد تكون لديكم على عنوان البريد الإلكتروني المرفق أدناه.

XXX@exeter.ac.uk

أ. ضع علامة (√) في العمود للإشارة إلى إجابتك على كل عبارة:

	هل البيانات التالية صحيحة؟	نعم	لا	لا أعرف
١	التعليم من الأقران هو نهج للتعلم ويشتمل على تلميذين يعملان معا أثناء الدراسة الأكاديمية لحفظ المعلومات اللازمة لعملية التقييم.			
٢	يمكن النظر إلى تدريس الأقران على أنه وسيلة تمكن التلاميذ من تقديم الدعم لبعضهم البعض، من خلال الانخراط في أنشطة من أجل مراجعة ما تعلموه.			
٣	يصف تدريس الأقران عملية التفاعل الاجتماعي التي تسمح لشخص واحد لنقل المعرفة و/أو المهارات إلى شخص آخر.			
٤	يمكن النظر إلى دور المعلمين في تدريس الأقران على أنه يساعد المتعلمين في التغلب على أي مشكلة غير مألوفة ويمكنهم من تقمص دور إشرافي محض عندما تستدعي الحاجة إلى ذلك.			
٥	تعرف استراتيجية تدريس الاقران بانها " عملية اكتساب المعرفة او المهارة من خلال المساعدة المستمرة والدعم مابين الاقران المتماثلة "			
٦	يمكن فهم "البالز" (استراتيجيات التعلم المدعومة من الأقران) من خلال نظرة التفاعل الاجتماعية للتنمية المعرفية، والتي قد تعود على الأقل لزمن فيغوتسكي.			
٧	يمكن وصف تدريس الأقران على أنه عملية تحفيز للنمو المعرفي نتيجة لتبادل الأفكار مع الآخرين من خلال الانخراط في أنشطة تعاونية تنطوي على حل المشكلات واستراتيجيات التدريس المحددة مسبقا.			
٨	.ليس من الضرورة كلا الفردين اللذان يطبقان استراتيدجية تدريس الاقران بصرف النظر عن الدور اللذان يقومان به سيكتسبون كمية متقاربة من الفائدة			
٩	.التفاعل بين الافراد من خلال العمل في مجموعه صغيرة تتكون من متعلمين اثنين تساعدهما على النمو المعرفي كنتيجة لكونهما قادرين على تكوين مفههوم وحل المشكلات.			
١٠	.تدريس الاقران يساعد الافراد ليصبحوا اكثر وعي بما لديهم من معرفة وكيف توصلوا اليها ولماذا يعرفونها.			

١١	بناء على نموذج "البالز"، من الأهمية بمكان أن نحرص على أن الطلاب الأكثر قدرة هم من يلعبون دائما دور المعلم في حين أن الطلاب الأقل قدرة هم من يقومون بدور المتعلم.				
١٢	العمل مع الاخرين يؤثر في احداث توقف لنمط التفكير التي اعتاد عليها الطفلل ليقوم بتنظيم جديد في نموه المعرفي.				
١٣	تشير الأدلة إلى أن تدريس الأقران على نطاق الفصل هي أكثر فعالية من تعليم الأقران حسب فئاتهم العمرية.				
١٤	يتم تطوير المهارات الأساسية نتيجة للتغذية الراجعة الفورية التي تحدث نتيجة للتفاعل بين شخصين خلال فترة النشاط.				
١٥	تعد التدريس الصفي للأقران أكثر ملاءمة للأطفال الذين يعانون من إعاقات معتدلة من تدريس الأقران عبر العمر .				
١٦	هناك ادلة تقول ان بعض الطلاب قد يرفضون تدريس الاقران الصفي بسبب انهم لا يشعرون بالراحة عندما يتم تدريسهم من خلال زملاؤهم بالصف .				
١٧	يعتبر تدريس الأقران الصفي أكثر صعوبة في التنفيذ من الناحية اللوجستية من تدريس الاقران عبر العمر .				
١٨	يتمثل أحد المكونات الرئيسية لتدريس الأقران في تقديم معلومات فورية عن عمل الشخص أثناء ممارسة النشاط.				
١٩	يخلق التدريس مع الأقران منطقة تنمية قريبة، مماثلة لتلك التي يتم إنشاؤها بين الأشقاء حيث يفترض من الشخص أكثر خبرة أو دراية أن يقوم بدور الطفل الأكبر سنا الذي يتعلم منه الآخرون.				
٢٠	تشير الدلائل البحثية إلى أن تبادل الأدوار الذي يحدث كجزء من التدريس الصفي مفيد لتنمية مهارات صنع القرار لدى الأطفال.				

ب ـ ضع علامة واحدة (√) فقط أو أكبر عدد ممكن أينما تجده ملائما:

١-يتضمن التدريس عبر السن...

أ) الأطفال الأكبر سنا من نفس الفئة ومجموعة الأقران ممن يقومون بمساعدة الآخرين

ب) الأطفال الأكبر سنا من فئة عمرية مختلفة ممن يساعدون الأطفال الأصغر سنا في عملية التعلم

ج) الأطفال الذين هم من نفس الفئة العمرية يعلمون بعضهم البعض.

د) لا أعرف

٢-"أثبت تدريس الأقران في كثير من الأحيان أنه أكثر صعوبة بكثير من حيث تنفيذه بطريقة ناجحة وذلك يعود إلى ..."

أ) التكلفة العالية

ب) نقص التدريب

ج) يستغرق وقتا طويلا

د) لا أعرف

٣-يمكن أن يؤثر تدريس الأقران في ...

أ) الإنجاز الأكاديمي

ب) مستويات المشاركة

ج) تنمر الأقران

د) مستويات التعلم

ه) معدلات التسرب من المدرسة

و) التواصل

ز) احترام الذات

ك) الدافعية للتعلم

ل) لا أعرف

٤-يشمل تدريس الأقران الصفي:

أ) تدريس الأقران المتبادل

ب) الممارسة الشاملة

ج) طلاب من مختلف الفصول الدراسية

د) طلاب من مختلف الأعمار يدرسون بعضهم البعض

ه) طلاب في نفس الفئة العمرية

و) لا أعرف

٥-ماهي العناصر التي تعتقد أنها صحيحة فيما يتعلق باستراتيجيات التعلم المدعومة من الأقران هي:

أ) هو نوع من الدمج بين التدريس الصفي للأقران والقياس القائم على المناهج الدراسية

ب) هو نوع من الدمج بين تعليم الأقران القائم على العمر والقياس القائم على المناهج الدراسية

ج) أنه ينطوي على أنشطة منظمة

د) ينطوي على أنشطة غير منظمة

ه) ينطوي على أدوار متبادلة

و) لا أعرف

لكم جزيل الشكر على إكمال هذا الاختبار

Appendix 7: Reliability – Statistics

Reliability- Knowledge Test about Peer Tutoring

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	5	17.2
	Excluded[a]	24	82.8
	Total	29	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.344	49

Reliability Statistics

Cronbach's Alpha	N of Items
.471	48

Reliability Statistics

Cronbach's Alpha	N of Items
.543	47

Reliability Statistics

Cronbach's Alpha	N of Items
.589	46

Reliability Statistics

Cronbach's Alpha	N of Items
.643	45

Reliability Statistics

Cronbach's Alpha	N of Items
.691	44

Reliability Statistics

Cronbach's Alpha	N of Items
.737	43

Reliability Statistics

Cronbach's Alpha	N of Items
.780	42

Reliability Statistics

Cronbach's Alpha	N of Items
.817	41

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
17.2000	23.200	4.81664	41

Reliability- Attitude to learning mathimatics

Case Processing Summary

		N	%
Cases	Valid	53	67.1
	Excluded[a]	26	32.9
	Total	79	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.818	.812	12

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
24.87	26.578	5.155	12

Appendix 8: Approval Letter for WRAT -4 Maths Subtest

Thank you for sending the revision Naeemh.

I am writing to let you know we have approved the back-translation (from Arabic to English) of the WRAT4. Please consider this email as our written authorization to proceed with reproduction of up to 300 copies of the Arabic WRAT4 Math Subtest per the terms of our agreement dated March 5, 2015.

Please make sure the final version used in your research contains the required PAR Credit Line per paragraph (1) as follows:

> "Adapted and reproduced by special permission of the Publisher, Psychological Assessment Resources, Inc., 16204 North Florida Avenue, Lutz, Florida 33549, from the Wide Range Achievement Test Revision 4 by Gary S. Wilkinson, PhD and Gary J. Robertson, PhD, Copyright 1993, 2006 by PAR, Inc. Further reproduction is prohibited without permission from PAR, Inc."

Please remember: Anyone wishing to use the translation must be directed to the publisher for permission.

If you have any questions, please let me know.

Best Regards,

Vicki McFadden
Permissions Specialist

Psychological Assessment Resources, Inc., 16204 N. Florida Avenue, Lutz, FL 33549, www.parinc.com
Telephone: (888) 799-6082; Fax: (800) 727-9329; Intl Fax: (813) 449-4109; e-mail: vmark@parinc.com

Appendix 9: Attitudinal Questionnaire

Name _____ Class_____

Direction:

I'm going to ask you some questions about your feeling towards maths. When you answer these questions, tell the truth. Don't worry what your teacher or parents might think. I'll be the only person who knows your answers. So tell me what you really think and feel by choosing the face that best matches your feeling.

Choose the face that best matches how you feel:

In mathematics lessons I feel ...	☺	😐	☹
Doing easy maths I feel **…**	☺	😐	☹
Doing hard maths I feel **…**	☺	😐	☹
Doing maths in my head I feel ...	☺	😐	☹
Doing maths in on paper I feel ...	☺	😐	☹
When I am asked maths questions I feel **…**	☺	😐	☹
When I am doing maths with equipment I feel **…**	☺	😐	☹

When I am doing maths with my partner I feel … *	☺	😐	☹
When I am doing maths on my own I feel …*	☺	😐	☹

What do you think about the following statements? Circle one of the answers.

Maths is one of my favourite subjects	**Yes**	**Not Sure**	**No**
I usually do well in mathematics	**Yes**	**Not Sure**	**No**
I like working with my partner on math tasks *	**Yes**	**Not Sure**	**No**

Note:

(*) those items added by the researcher

Attitudinal Questionnaire (Arabic version)

استبيان

الاسم :..... **الصف** :.....

التعليمات :

ساقوم بطرح بعض الاسئلة عليك حول مشاعرك تجاه الرياضيات. عندما تجيبين على الاسئلة عبري عن رأيك بصراحة دون ان تشعري باي قلق حول ردة فعل معلمتك او والديك . ساكون انا فقط من يعرف ويطلع على اجاباتك لذلك اخبريني عن رايك ومشاعرك الحقيقيه عن طريق اختيار الوجه الذي يمثل فعلا ما تشعرين به .

اختاري فيما يلي الوجه الذي يمثل فعلا ما تشعرين به :

	☺	😐	☹
في حصص الرياضيات اشعر	☺	😐	☹
عند القيام بحل المسائل الحسابية السهله اشعر.....	☺	😐	☹
عند القيام بحل المسائل الحسابية الصعبة اشعر.....	☺	😐	☹

عند القيام بحل المسائل الحسابية الشفهية اشعر.....	☺	😐	☹
عند القيام بحل المسائل الحسابية المكتوبة اشعر.....	☺	😐	☹
عندما تطرح علي اسئلة في الحساب اشعر.....	☺	😐	☹
عندما اقوم بالحساب باستخدام ادوات اشعر.....	☺	😐	☹
عندما اقوم بحل المسائل الحسابية مع زميلتي اشعر.....*	☺	😐	☹
عندما اقوم بحل المسائل الحسابية بمفردي اشعر..... *	☺	😐	☹

ماهو رأيك في العبارات التالية ؟ ضعي دائرة حول احدى الاجابات .

مادة الحساب هي من المواد المفضلة لدي	**نعم**	**لست متاكدا**	**لا**
غالبا ما اقوم باداء جيد في الحساب	**نعم**	**لست متاكدا**	**لا**
احب ان اعمل مع زميلتي في الصف اثناء حل المسألة حسابية *	**نعم**	**لست متاكدا**	**لا**

ملاحظة :

(*) هذه الاسئلة تمت اضافتها من الباحث

Appendix 10: Observation Checklist for Maths PALS Implementation

Teacher: ---------- School: ---------- Observer: ----------

# of Students Present: ---------- Grade: ---------- Session #:----------

PALS Overall --------- Start time: ---------- End Time: ----------

Direction: During the observation, place a checkmark in the "+" for each step observed. Tally the number of "+" and calculate integrity for each part and overall integrity (see summary form at end of this sheet).

Part 1: Introduction or Review of PALS session

Tick as many of those items as you observe them being done:

+	Step	Checklist
	1	Teacher lets students know it's time for PALS
	2	Teacher reviews PALS rules with class: Be nice and helpful. Talk only to your partner and talk only about math. Use a soft PALS voice.
	3	Teacher introduces or reviews concept
	4	Teacher reviews/demonstrates Tutor's job
	5	Teacher reviews/demonstrates Tutee's job
	6	Teacher reviews/demonstrates correction procedures
	7	Teacher reminds students when to switch roles
	8	Teacher names pairs and identifies first Tutors
	9	Teacher has pairs sit together
	10	Teacher passes out folders and necessary materials
	11	Teacher tells students to take materials out of folder

Comments:

Number of +/11= ---------- % Introduction/ Review Fidelity

Part 2: PALS Activity

Teacher Behaviours

+	Step	Checklist
	1	Teacher is constantly observing and helping pairs
	2	Teacher awards extra " smiley faces" for good PALS behaviour and work
	3	Teacher provides positive feedback, if applicable (e.g good job, excellent)
	4	Teacher provides corrective feedback, if applicable

Comments:

Number of +/4= ---------- % Teacher Behaviour Fidelity

Part 3: PALS Activity

Student Behaviours

Pair observed---------- & ----------

+	Step	Checklist
	1	Students begin activities when asked
	2	Tutors appropriately use correct commands on side of game board to participate in their role
	3	Tutees appropriately participate in their role
	4	Tutors use correction procedure when applicable *Correction procedure: "Stop, you miss that one. Can you figure it out? (wait 4 seconds) Tutor helps player to find the answer through demonstration, she does not tell answer unless Tutee continually struggles*
	5	Students reverse role when signaled on their game board
	6	Students cooperate
	7	Student stay on task
	8	Students award themselves " smiley face "

Comments:

Number of +/8= ---------- % Student Behaviour Fidelity

Student Behaviours

Pair observed---------- & ----------

+	Step	Checklist
	1	Students begin activities when asked
	2	Tutors appropriately use correct commands on side of game board to participate in their role
	3	Tutees appropriately participate in their role
	4	Tutors use correction procedure when applicable *Correction procedure: "Stop, you miss that one. Can you figure it out? (wait 4 seconds) Tutor helps player to find the answer through demonstration, she does not tell answer unless Tutee continually struggles*
	5	Students reverse role when signaled on their game board
	6	Students cooperate
	7	Student stay on task
	8	Students award themselves " smiley face "

Comments:

Number of +/8= ---------- % Student Behaviour Fidelity

Student Behaviours

Pair observed---------- & ----------

+	Step	Checklist
	1	Students begin activities when asked
	2	Tutors appropriately use correct commands on side of game board to participate in their role
	3	Tutees appropriately participate in their role
	4	Tutors use correction procedure when applicable *Correction procedure: "Stop, you miss that one. Can you figure it out? (wait 4 seconds) Tutor helps player to find the answer through demonstration, she does not tell answer unless Tutee continually struggles*
	5	Students reverse role when signaled on their game board
	6	Students cooperate
	7	Student stay on task
	8	Students award themselves " smiley face "

Comments:

Number of +/8= ---------- % Student Behaviour Fidelity

Summary

Activity	Number of +	Total Number Possible	%
Introduction/ Review		11	
Teacher Behaviours		4	
Students Behaviours		8	
Students Behaviours		8	
Students Behaviours		8	
Overall		39	

Overall Suggestions / comments

Observation Checklist for Maths PALS Implementation (Arabic version)

المعلمة : ..... المدرسة :..... اسم الملاحظة :.....

عدد الحضور من الطالبات :..... الصف :..... رقم جلسة الملاحظة :.....

مدة جلسة " بالس" : ..... الوقت عند بداية الجلسة :..... الوقت عند نهاية الجلسة :.....

التعليمات : خلال فترة الملاحظة ضعي اشارة (+) لكل خطوة تتم ملاحظتها اجمعي عدد اشارات (+) واحسبي نسبة الاتفاق بين الملاحظين لكل جزء على حدة ثم احسبي مجموع نسبة الاتفاق للاجزاء معا (انظري الى جدول ملخص الدرجات في نهاية الصفحة).

الجزء الاول : التهيئة لجلسة بالس ومراجعة القوانين

ضعي اشارة عند الخطوات التي تمت ملاحظتها فيما يلي :

+	الخطوات	قائمة الملاحظة
	١	**تخبر المعلمة الطالبات انه حان الان وقت جلسة بالس**
	٢	**تسترجع المعلمة مع طالبات الصف قوانين بالس:** **كوني لطيفه مع زميلتك ومحبة للمساعدة** **تحدثي فقط مع زميلتك التي تشاركك نشاط بالس وتحدثي فقط حول الرياضيات** **تحدثي بصوت بالس الهادئ**
	٣	**تعرض او تراجع المعلمة مع الطالبات احدى مفاهيم الرياضيات**
	٤	**تسترجع المعلمة مع الطالبات مها م الطالبة التي تقوم بدور "المعلمة "**
	٥	**تسترجع المعلمة مع الطالبات مهام الطالبه التي تقوم بدور " الطالبة "**
	٦	**تسترجع المعلمة مع الطالبات خطوات اجراءات التصحيح**
	٧	**تذكر المعلمة الطالبات بوقت تبادل الادوار**
	٨	**تسمي المعلمة الاقران وتحدد من سيقوم بدور المعلمات اولا**
	٩	**تجلس الطالبات معا في اقران ثنائية**
	١٠	**توزع المعلمة الملفات والادوات المناسبة على الطالبات**
	١١	**تطلب المعلمة من الطالبات استخلراج انشطة الحساب من الملفات**

الملاحظات :

مجموع عدد + / ١١ = ... % نسبة الاتفاق على التهيئة لجلسة بالس ومراجعة القوانين

الجزء الثاني: نشاط بالس

سلوكيات المعلمة

+	الخطوات	قائمة الملاحظة
	١	تراقب المعلمة الاقران الثنائية باستمرار وتقدم لهم المساعدة
	٢	تكافئ المعلمة المجموعات الثنائية التي تعمل بشكل جيد على نشاط بالس " بوجوه ضاحكة " اضافيه
	٣	تقدم المعلمة التغذية الراجعة الايجابية . اذا كان ينطبق (مثل : عمل رائع ، ممتاز)
	٤	تقدم المعلمة التغذية الراجعة التصحيحية . اذا كان ينطبق

الملاحظات :

مجموع عدد + / ٤ = ... % نسبة الاتفاق على سلوك المعلمة

الجزء الثالث : نشاط بالس

سلوكيات الطالبة

الاقران التي ستتم ملاحظتهما: ..... و .....

+	الخطوات	قائمة الملاحظة
	١	تبدا الطالبات نشاط بالس عندما يطلب منهم ذلك
	٢	تقوم الطالبه "التي تمثل دور المعلمة " بطرح الاسئلة الخاصة بورقة نشاط بالس بشكل صحيح
	٣	تقوم الطالبة "التي تمثل دور التلميذة" بدورها بشكل صحيح
	٤	تسستخدم الطالبة " التي تمثل دور المعلمة " اجراءات التصحيح عندما يكون ذلك مناسب اجراءات التصحيح : "توقفي، لقد اخطأتي هنا . هل بامكانك ان تحاولي معرفة الحل ؟ (تنتظر ٤ ثواني) بعدها تقوم الطالبه "المعالم" بالمساعدة للوصول الى الحل عن طريق الشرح ولا تقول الاجابة الا عندما تتعثر التلميذة بعد عدة محاولات.
	٥	تتبادل الطالبات الادوار عندما يصلون الى اشارة تبادل الادوار على لوحة نشاط بالس
	٦	تتعاون الطالبات معا
	٧	تستمر الطالبات في العمل في المهمة
	٨	تكافأ الطالبات انفسهن بالوجوه المبتسمة

الملاحظات :

مجموع عدد + / ٨ = ... % نسبة الاتفاق على سلوك الطالبات

الجزء الثالث : نشاط بالس

سلوكيات الطالبة

الاقران التي ستتم ملاحظتهما: ..... و .....

+	الخطوات	قائمة الملاحظة
	١	تبدا الطالبات نشاط بالس عندما يطلب منهم ذلك
	٢	تقوم الطالبه "التي تمثل دور المعلمة " بطرح الاسئلة الخاصة بورقة نشاط بالس بشكل صحيح
	٣	تقوم الطالبة "التي تمثل دور التلميذة" بدورها بشكل صحيح
	٤	تسستخدم الطالبة " التي تمثل دور المعلمة " اجراءات التصحيح عندما يكون ذلك مناسب اجراءات التصحيح : "توقفي، لقد اخطأتي هنا . هل بامكانك ان تحاولي معرفة الحل ؟ (تنتظر ٤ ثواني) بعدها تقوم الطالبه "المعالم" بالمساعدة للوصول الى الحل عن طريق الشرح ولا تقول الاجابة الا عندما تتعثر التلميذة بعد عدة محاولات.
	٥	تتبادل الطالبات الادوار عندما يصلون الى اشارة تبادل الادوار على لوحة نشاط بالس
	٦	تتعاون الطالبات معا
	٧	تستمر الطالبات في العمل في المهمة
	٨	تكافأ الطالبات انفسهن بالوجوه المبتسمة

الملاحظات :

مجموع عدد + / ٨ = ... % نسبة الاتفاق على سلوك الطالبات

الملخص العام

النشاط	عدد اشارة +	مجموع عدد السلوك الملاحظ	%
التهيئة لجلسة بالس ومراجعة القوانين			
سلوكيات المعلمة			
سلوكيات الطالبات			
سلوكيات الطالبات			
سلوكيات الطالبات			
المجموع الكلي			

ملاحظات عامة

Appendix 11: Semi Structured Interview for Math PALS Intervention (With Trainee Teachers)

Aim

The interview will aim to understand trainee teachers' experiences about using Math PALS in their teaching practice placement

Beginning the interview with a welcoming atmosphere

- Introduce myself and the purpose of the interview**.**
- Be sure to allow the trainees to offer criticism and show them that I'm open to learning from anyone by saying that "You know just because I've taught you how to use PALS does not mean that I want you to say only positive things about PALS. Please feel free to be very honest with me about what you truthfully feel about PALS".
- Approximate length of the interview (30 minutes)
- Assurance of confidentiality and anonymity
- Purpose of digital recorded – ask permission to use it – explain that the tape will be only heard by researcher.
- Assure participant that she can decline to answer a question or withdraw any time
- Obtain informed consent

Math PALS Intervention:

1-Can you describe PALS in math for me as you see it?

2-What do you see as Key principles/ components of the programme?

3-Do you see Math PALS as a supplement or a substitute?*

4- How do you compare PALS with the other teaching strategies you have done during your teaching placement? Is there a conflict between the PALS strategy and other methods? *

Strengths (of what you learnt to do by using PALS for Math)

5- What do you see as the major strengths of PALS for your situation?

Which parts do you like best?

Which parts do your students like best?

6- What was most helpful way about the way the PALS researcher trained and worked with you?

7- What do you think of PALS influence for students? For teachers? **

Weaknesses and Limitations

8- Some people have this view about PALS : "peer training and monitoring require additional planning time and effort on the part of the teachers, which is frustrating because it might increase the teacher's responsibilities ". What do you think? *

9- Have you seen anything in your experience of PALS in your teaching practice, that you think might make it harder or easier for you to adopt this strategy? Or, do you feel that PALS might not fit in very well with our local context? *

10- What limitation or weaknesses do you see on the original way you were trained to use math PALS programme? Have you made any attempts to do anything about these weaknesses?

11-Any thoughts about better ways for researcher to work with teachers?

Wrap-Up

12- Looking to the future, would you like to use the PALS strategy to teach math when you become a teacher? Why? Why not? *

13 Can you summarize for me where you see yourself right now in relation to the use of PALS for mathematics?

14- Is there anything else you would like to say?

Note: All those items (*) added by researcher.

This items (**) modified by researcher

Semi Structure Interview (Arabic version)

الهدف

تهدف المقابلة الى فهم وجهات نظر طالبات التدريب الميداني حول استخدام احدى استراتيجيات تدريس الاقران في الرياضيات (بالس) اثناء فترة التدريب الميداني .

التهيئة اللمقابلة :

- الترحيب وتعريف الباحث بنفسه والهدف من المقابلة .
- التاكيد على حرية التعبير عن الرأي والانتقاد فالباحث يرغب في سماع وجهة النظر الحقيقة حول الاستراتيجية دون مجاملة الباحث بذكر الجوانب الايجابية فقط . فلا يعني ان الباحث قام بالتدريب على الاستراتيجية انه عليك ان تتحدث فقط بايجابية عن الاستراتيجية . لذلك اشعري براحة تامة في التعبير بصراحة عن رأيك.
- تستغرق مدة المقابلة ٣٠ دقيقة تقريبا
- ضمان السرية التامة وعدم الافصاح عن اي معلومات تدل على هوية الشخص الذي تمت مقابلته
- طلب الاذن لاستخدام التسجيل الصوتي وتوضيح الهدف من استخدامه حيث يحفظ بمكان امن ولا يستمع اليه الا الباحث وسيتم اتلافه بعد تحليل البيانات .
- تأكيد الحق على الانسحاب في اي لحظة اثناء اجراء المقابلة او رفض الاجابة عن اي سؤال من اسئلة المقابلة .

اسئلة المقابلة

اسئلة تتعلق ببرنامج التدخل في الرياضيات (بالس)

1- كيف تصفين استراتيجية (بالس) في الرياضيات كما ترينها؟
2- ماهي المكونات الاساسية لبرنامج (بالس) كما ترينها ؟
3- هل ترين استراتيجية (بالس) في الرياضيات تستخدم كبديل لطريقة اخرى في التدريس او انها تستخدم كطريقة اضافية للطرق الاخرى ؟
4- كيف تقارنين (بالس) بالطرق الاخرى في التدريس التي قمتي باستخدامها اثناء فترة تدريبك الميداني؟ هل هناك اي تعارض بين استراتيجية (بالس) والاستراتيجيات الاخرى ؟ *

اسئلة تتعلق بنقاط القوة (التي تعلمتيها من استخدام استراتيجية بالس في الرياضيات)

5- ماهي ابرز نقاط القوة لبرنامج بالس كما ترينها من الناحية الشخصية ؟

ماهو الجزء المفضل بالنسبة لك ؟
ماهو الجزء المفضل بالنسبة لطالباتك ؟

6- ماهي طريقة التدريب على برنامج بالس التي ترين انها كانت الاكثر فائدة اثناء تدريب الباحث لك على تطبيق الاستراتيجية ؟
7- باعتقادك ماهو اثر برنامج بالس على الطالبات ؟ على المعلمات ؟ **

اسئلة تتعلق بنقاط الضعف والمعوقات

8- بعض وجهات النظر حول استراتيجة بالس تقول " ان هذه الاستراتيجية تتطلب متابعة وتخطيط تستدعي وقت وجهد اضافي من قبل المعلمة مما يسبب الازعاج للمعلمة بسبب زيادة المسئوليات على عاتقها " ماهو رأيك ؟ *
9- من خلال تجربتك مع برنامج بالس اثناء التدريب الميداني . هل وجدتي اي شيء باعتقادك انه يصعب او يسهل عملية تبني هذه الاستراتيجية ؟ او هل تعتقدين ان استراتيجية بالس لا تتناسب بشكل تام مع نظامنا التعليمي الحالي ؟ *
10-ماهي المعوقات ونقاط الضعف التي وجدتيها في طريقة تدريبك على برنامج بالس ؟ هل قمتي باي محاولات لتخطي هذه العقبات ؟
11- اي اقتراحات او افكار حول طرق افضل يقوم بها الباحث عند تدريب العلمات ؟

اسئلة تتعلق بانهاء المقابلة

12- بالنظر الى المستقبل هل لديك الرغبه في استخدام استراتيجية بالس في تدريس الرياضيات عندما تصبحين معلمة ؟ لماذا ؟ ولماذا لا ؟ *
13- هل بامكانك ان تصفي باختصار اين ترين نفسك حاليا بالنسبة لعلاقتك مع استخدام برنامج بالس في الرياضيات ؟
14-هل هناك شيء اخر ترغبين في اضافته او قوله ؟

Appendix 12: Permission and All Ethical forms

Permission from King Saud University in Saudi Arabia

Kingdom of Saudi Arabia
Ministry of Higher Education
King Saud University
Code 034
College of Education

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة التعليم العالي
جامعة الملك سعود
رمزها ٠٣٤
كلية التربية

Date: ١٤٣٦/٢/٨ التاريخ: No.: ..... الرقم:

إلى من يهمه الأمر

السلام عليكم ورحمة الله وبركاته ... وبعد:

بناءً على طلب طالبة الدكتوراه / نعيمة عبدالرحمن أحمد الحسن ، ورقمها الوظيفي (٢٦٦١٥) والمبتعثة بجامعة اكستير في بريطانيا، بإجراء رسالة الدكتوراه في المملكة العربية السعودية ، حيث تتضمن دراستها إجراء دراسة ميدانية للطالبات في المملكة ، فإنه لا مانع لدينا من حضور المبتعثة/ نعيمة الحسن، وعمل دراستها الميدانية في الفصل الدراسي الأول للعام القادم ١٤٣٦/١٤٣٧هـ ولمدة ثلاثة أشهر.

وتقبلوا خالص التحية والتقدير،،،

رئيس قسم التربية الخاصة

د. تركي بن عبدالله القريني

جامعة الملك سعود
قسم التربية الخاصة
كلية التربية

BUREAU VERITAS Certification
IND 10.5084

P. O. Box 2458, Riyadh 11451 Tel 4674821 Fax.: 4676045
ص .ب ٢٤٥٨ الرياض ١١٤٥١ هاتف: ٤٦٧٤٨٢١ فاكس: ٤٦٧٦٠٤٥
www.ksu.edu.sa

Certificate of Ethical Approval from Exeter University

UNIVERSITY OF EXETER

GRADUATE SCHOOL OF EDUCATION

St Luke's Campus
Heavitree Road
Exeter UK EX1 2LU

http://socialsciences.exeter.ac.uk/education/

CERTIFICATE OF ETHICAL APPROVAL

Title of Project: Special education trainee teachers: developing and evaluating peer tutoring programme in Saudi Arabia

Researcher(s) name: Naeemh Alhasan

Supervisor(s): Brahm Norwich
Jane Seale

This project has been approved for the period

From: 01/10/2015
To: 31/12/2015

Ethics Committee approval reference: D/15/16/02

Signature: Date…12/08/2015……
(Dr Philip Durrant, Chair, Graduate School of Education Ethics Committee)

Leaflet and Informed consent for school's principal

Information leaflet for School

Dear school's principle

This letter was prepared to ask you to take a part in a research project as a part of a PhD study. Naeema Alhasan, ID No: 610029314 is interested in undertaking a research study at your school. The research project was described below in detail.

***Title of the Study*:** Developing and evaluating Peer Tutoring programme for trainee teachers of SEN children in Saudi Arabia (Maths PALS)

Aims and purposes of the project:

- To develop an effective peer tutoring programme called Math PALS (Peer Assisted Learning strategies) for SEN children. A group of trainee teachers will conduct Math PALS programme three times a week for three months in their teaching practice placement. Each session lasts approximately 20-25 minutes. During each session, all students in the class are paired and work together on a game board introduced during the trainee teacher lessons.
- To evaluate the process at both university level and at classrooms level in order to draw answers to the research questions. At University level the participants (trainees) will be assessed as to their knowledge of peer tutoring and to evaluate the quality of their implementation of such a form of peer tutoring (Math PALS) as a part of the teaching practice. In the classroom, the peer tutoring programme (Math PALS) will be assessed in terms of the levels of improvement in mathematic for each pupil who is exposed to the programme and their levels of motivation with regard to mathematic

Research Questions

At University Level**:**

- What gains in knowledge are evident for the special education teacher trainees who have undertaken a preparatory peer tutoring course?
- To what extent do special education trainee teachers implement peer tutoring programme (Math PALS) according to expected guidelines in their teaching?

At Class Level:

- To what extent does engaging in peer tutoring programme (Math PALS) result in improvements in mathematic for pupils with intellectual disabilities?

- To what extent does engaging in the peer tutoring programme (Math PALS) result in positive changes in the attitude of pupils who have intellectual disabilities towards mathematic?

Methods and data collection

1- Math PALS (Peer Assisted Learning Strategies) adapted to employ peer tutoring programme in mathematics in special education classrooms.
2- Pre-Test/Post-Test WRAT 4 sub-tests to assess math knowledge of pupils.
3- Observation checklists to support and monitor the trainees' performance and the math PALS implementation in the classroom. It also provides the researcher with example of the 'real behaviour' of individual learners as they come to terms with this form of teaching and learning.
4- Pre-Post Questionnaire to explore pupils' attitudes and feelings towards mathematics.

Informed Consent

I have been fully informed about the aims and purposes of the project.

I understand that:

there is no compulsion for the school to participate in this research project and, if the principal of the school do choose to participate, the school may at any stage withdraw its participation and may also the principal of school request that school's data be destroyed

The principal has the right to refuse permission for the publication of any information about the school

any information which school gives will be used solely for the purposes of this research project, which may include publications or academic conference or seminar presentations

if applicable, the information, which school gives, may be shared between any of the other researcher(s) participating in this project in an anonymised form

all information school gives will be regarded as strictly confidential

the researcher(s) will make every effort to preserve my anonymity

Printed name of participant: ……

.....…… .....

(Signature of principal of school's participant) Date

One copy of this form will be kept by the participant; a second copy will be kept by the researcher(s)

Contact phone number of researcher: xxxxxxx
If you have any concerns about the project that you would like to discuss, please contact:
……naaa203@exeter.ac.uk……
OR
…… B.Norwich@exeter.ac.uk ……
* when research takes place in a school, the right to withdraw from the research does NOT usually mean that pupils or students may withdraw from lessons in which the research takes place

Data Protection Act: The University of Exeter is a data collector and is registered with the Office of the Data Protection Commissioner as required to do under the Data Protection Act 1998. The information you provide will be used for research purposes and will be processed in accordance with the University's registration and current data protection legislation. Data will be confidential to the researcher(s) and will not be disclosed to any unauthorised third parties without further agreement by the participant. Reports based on the data will be in anonymised form.

Revised March 2013

Leaflet and Informed consent for trainee teachers

Dear Trainee Teacher

This letter was prepared to ask you to take a part in a research project as a part of a PhD study. Naeema Alhasan, ID No: xxxx is interested in undertaking a research study in peer tutoring. The research project was described below.

Title of Research Project: Developing and evaluating Peer Tutoring programme for trainee teachers of SEN children in Saudi Arabia (Maths PALS)

Aims and purposes of the project

1. To develop an effective peer tutoring programme called Math PALS (Peer Assisted Learning strategies) for SEN children. A group of trainee teachers will conduct Math PALS programme three times a week for 12 weeks in their teaching practice placement. Each session lasts approximately 20-25 minutes. During each session, all students in the class are paired and work together on a game board introduced during the trainee teacher lesson.
2. To evaluate the process at both university level and at classrooms level in order to draw answers to the research questions. At University level the participants will be assessed as to their knowledge of peer tutoring and to evaluate the quality of their implementation of such a form of peer tutoring (Math PALS) as a part of the teaching practice. In the classroom, the peer tutoring programme (Math PALS) will be assessed in terms of the levels of improvement in mathematic for each pupil who is exposed to the programme and their levels of motivation with regard to mathematic.

What we will provide you:

- Training course: trainee teachers, who formed PALS group, will be trained on Math PALS programme (6 hours training course). Peer tutoring and Math PALS will be explained its principles, theories and forms in order to provide you with the skills to be able to introduce it in your teaching practice placement. At the end of the intervention, trainee teachers in non-PALS group will be trained on maths PALS.
- Training on how to administer WRAT 4 maths sub- test and attitudinal questionnaire.
- PALS manual and PALS materials.

What you will have to do:

- You will administer:

  WRAT- 4 Maths subtest (Blue, Green Form)

  Attitudinal Questionnaire to learning maths

- PALS group will implement the maths PALS programme in maths lessons three times a week for three months in their maths lessons
- Non PALS group will implement conventional methods in their maths lessons.
- There will be some observations in your classroom during PALS sessions by observers.
- PALS teachers will be interviewed at the conclusion of the project.

INFORMED CONSENT

I have been fully informed about the purposes and the details of the project.

I understand that:

- There is no compulsion for me to participate in this research project and, if I do choose to participate, I may at any stage withdraw my participation and may also request that my data be destroyed.
- I have the right to refuse permission for the publication of any information about me.
- The entire interview will be digital-recorded and all information recorded is confidential, and no one else except the researcher will have access to the recorded information. The voice-recorded will be deleted after the data be analysed.
- If I feel uncomfortable in any way during the interview session, I have the right to decline

  to answer any question or to end the interview.
- I have the right to refuse permission for use digital voice recorder in the interview.
- Any information which I give will be used solely for the purposes of this research project,

  which may include publications or academic conference or seminar presentations
- If applicable, the information, which I give, may be shared between any of the other researcher(s) participating in this project in an anonymized. The researcher will make every effort to preserve your anonymity.

- All collected information will be regarded as strictly confidential.

By sign below I confirm that I am willing to participate in the project.

(Signature of participant) (Date)

(Printed name of participant)

One copy of this form will be kept by the participant; a second copy will be kept by the researcher(s)

Contact phone number of researcher…….

If you have any concerns about the project that you would like to discuss, please contact:

……naaa203@exeter.ac.uk……
OR
…… B.Norwich@exeter.ac.uk……

* when research takes place in a school, the right to withdraw from the research does NOT usually mean that pupils or students may withdraw from lessons in which the research takes place

Data Protection Act: The University of Exeter is a data collector and is registered with the Office of the Data Protection Commissioner as required to do under the Data Protection Act 1998. The information you provide will be used for research purposes and will be processed in accordance with the University's registration and current data protection legislation. Data will be confidential to the researcher(s) and will not be disclosed to any unauthorised third parties without further agreement by the participant. Reports based on the data will be in anonymised form.

Revised March 2013

PASSIVE PARENTALCONSENT

Dear Parent or Guardian:

Your child's school will be participating in research project in pedagogical experimental study. The research project is about developing and evaluating Peer Tutoring programme (Math PALS). The aim of this research is to gain a greater appreciation of how Math peer tutoring works, its effects on pupil learning and to develop an effective Math peer tutoring programme for use within the Kingdom for those in Special Education in an effort to raise standards of mathematics skills.

The programme activities designed for the whole class and all students will be involved in maths activities three times a week and during the math lesson for 20-25 minutes. Implementation of the intervention is a part of the course curriculum of mathematics. Your child's grade does not depend on answering the questions.

It is Voluntary. Your child does not have to participate in the programme and she may withdraw at any time. *If you do not want your child to participate in the research, you must notify your school.*

It is Anonymous. No names will be recorded or attached to the data. Also all collected information will be made available for analysis only under strict confidentiality controls.

Potential Risks. None of the research methods cause psychological or social harm or put the participants under stress. It's because those methods only for asking them questions about Math learning and their feeling towards math and peer tutoring. For further information or any personal questions that may materialize, please contact the school.

If you do not want your child to participate, please complete and return the form below to the school. If you have any questions with regard to the project, please do not hesitate to contact XXX at school. Unless we hear from, we will assume that you give permission for your child to participate in this project.

Yours Sincerely,

XXXX

Tel:XXXX

Naaa203@exeter.ac.uk

Withdrawal Form

By returning this form, **I *do not give permission*** for my child to be in the Peer Tutoring programme.

(Please Print) My child's name is: …….. Grade: ……

Teacher's name or Class subject: ……..

Signature: …….

Date:……..

Assent to participate in a research study and leaflet for children

Dear Student

I am a PhD student and my name is Naeema Alhasan. I study at the University of Exeter. I am doing a study to learn about Peer Tutoring. This study considers as a dissertation to my degree.

I will tell you some information about my research project and I will explain what will happen in your school.

We are doing a study to learn about Peer Tutoring programme in mathematics which is called PALS (Peer Assisted Learning Strategies).

We are asking you to help because we don't know very much about the use of Peer Tutoring programme to improve students' skills in mathematics within the Kingdom. All the pupils in your class will be asked to take part of this study. Your parents know about the study too.

If you agree to be in our study, we will ask you to participate in mathematics activities that designed for the whole class three time a week during math lessons for 20-25 minutes.

We will ask you to answer math tests. Your grade does not depend on answering the test.

We will ask you about your feelings towards mathematics and no one will be upset of your feelings.

Also there will be some observations in the classroom.

You may ask us questions at any time.

You can say 'no' to what we ask you to do for the mathematics PALS at any time and we will stop.

You do not have to be in this study if you do not want to be. If you decide to stop after we begin, that's okay too.

Any collected information will be kept secret and you will not be identified at any stage.

If you sign this paper, it means you have read/ have been told about our study and you want to be in the study.

If you don't want to be in the study, don't sign the paper. Being in the study is up to you, and no one will be upset if you don't sign the paper, or if you change your mind later.

Yours sincerely,

XXXXX

Contact Number

XXXXX

By sign below I confirm that I am willing to participate in the project.

Child's name: ……..

Signature ……

Date …….

Researcher's Signature: ……

Date: …….

Appendix 15

PALS Implementation Fidelity

(Fidelity of Implementation of PALS Procedures Given by 5 Teachers) Introduction / Review

		Introduction /Review Session no.1	Introduction /Review Session no.2	Introduction /Review Session no.3	Introduction /Review Session no.4	Introduction /Review Session no.5	Introduction /Review Session no.6	Introduction /Review Session no.7	Introduction /Review Session no.8
1		100.00	90.90	100.00	100.00	90.90	100.00	100.00	100.00
2		90.90	100.00	100.00	100.00	100.00	100.00	100.00	100.00
3		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4		81.81	100.00	100.00	81.81	100.00	100.00	100.00	100.00
5		90.90	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total	Mean	92.7220	98.1800	100.0000	96.3620	98.1800	100.0000	100.0000	100.0000
	Median	90.9000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000

Appendix 13: Tables of Fidelity of the Observations' Scores as Percentages

(Fidelity of Students' Implementing of PALS Procedures) Improvement in Students' Learning to Use the PALS Procedures

Trainee		Students Behaviours Session no.1	Students Behaviours Session no.2	Students Behaviours Session no.3	Students Behaviours Session no.4	Students Behaviours Session no.5	Students Behaviours Session no.6	Students Behaviours Session no.7	Students Behaviours Session no.8
1		50.00	62.50	75.00	87.50	100.00	100.00	100.00	100.00
2		62.50	75.00	87.50	87.50	100.00	100.00	100.00	100.00
3		87.50	87.50	100.00	100.00	100.00	100.00	100.00	100.00
4		50.00	62.25	62.25	75.00	75.00	100.00	100.00	100.00
5		62.50	87.50	87.50	75.00	87.50	100.00	100.00	100.00
Total	Mean	62.5000	74.9500	82.4500	85.0000	92.5000	100.0000	100.0000	100.0000
	Median	62.5000	75.0000	87.5000	87.5000	100.0000	100.0000	100.0000	100.0000

(Fidelity of Amount of Assistance Given by 5 Teachers to Pairs) Teachers Behaviours Fidelity

Trainee		Teacher Behaviours Session no.1	Teacher Behaviours Session no.2	Teacher Behaviours Session no.3	Teacher Behaviours Session no.4	Teacher Behaviours Session no.5	Teacher Behaviours Session no. 6	Teacher Behaviours Session no.7	Teacher Behaviours Session no.8
1		75.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
3		100.00	75.00	100.00	100.00	100.00	100.00	100.00	100.00
4		75.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
5		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total	Mean	90.0000	95.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000
	Median	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000

(Fidelity of Overall Implementation of All Aspects of PALS)

Trainee		Overall of Implementing PALS Session no.1	Overall of Implementing PALS Session no.2	Overall of Implementing PALS Session no.3	Overall of Implementing PALS Session no.4	Overall of Implementing PALS Session no.5	Overall of Implementing PALS Session no.6	Overall of Implementing PALS Session no.7	Overall of Implementing PALS Session no.8
1		75.00	84.47	91.67	95.83	96.97	100.00	100.00	100.00
2		84.47	91.67	95.83	95.83	100.00	100.00	100.00	100.00
3		95.83	87.50	100.00	100.00	100.00	100.00	100.00	100.00
4		68.94	87.42	87.42	85.60	91.67	100.00	100.00	100.00
5		84.47	95.83	95.83	91.67	95.83	100.00	100.00	100.00
Total	Mean	81.7407	89.3767	94.1500	93.7873	96.8933	100.0000	100.0000	100.0000
	Median	84.4667	87.5000	95.8333	95.8333	96.9667	100.0000	100.0000	100.0000

IRS1 = Introduction /Review Session no.1

TBS1= Teacher Behaviours Session no.1

SBS1= Students Behaviours Session no.1

OverallS1= Overall implementing all aspects of PALS features Session no.1

Appendix 14: WRAT-4 Maths Subtest- Statistics

Normality testing on the variable of Maths scores (Skewness & Kurtosis)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Total Pre-scores Attitude to Maths	53	16	33	24.87	5.155	-.003-	.327	-1.132-	.644
Total Post-scores Attitude to Maths	53	17	36	29.40	4.916	-.871-	.327	-.101-	.644
Valid N (listwise)	53								

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total Raw Score of the pretest of Maths	.167	53	.001	.913	53	.001
Total Raw Score of the posttest of Maths	.116	53	.074	.944	53	.016

a. Lilliefors Significance Correction

Mixed between-within subjects ANCOVA

Within-Subjects Factors

Measure: MEASURE_1

Time	Dependent Variable
1	TotalRaw1
2	TotalRaw2

Between-Subjects Factors

		Value Label	N
Group	1	Control Group	27
	2	Intervention Group	26

Descriptive Statistics

	Group	Mean	Std. Deviation	N
Total Raw Score of the pretest	Control Group	7.33	6.805	27
	Intervention Group	11.19	4.167	26
	Total	9.23	5.941	53
Total Raw Score of the posttest	Control Group	11.85	6.175	27
	Intervention Group	17.81	2.417	26
	Total	14.77	5.560	53

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.228	14.743[b]	1.000	50.000	.000	.228
	Wilks' Lambda	.772	14.743[b]	1.000	50.000	.000	.228
	Hotelling's Trace	.295	14.743[b]	1.000	50.000	.000	.228
	Roy's Largest Root	.295	14.743[b]	1.000	50.000	.000	.228
Time * Age	Pillai's Trace	.000	.008[b]	1.000	50.000	.928	.000
	Wilks' Lambda	1.000	.008[b]	1.000	50.000	.928	.000
	Hotelling's Trace	.000	.008[b]	1.000	50.000	.928	.000
	Roy's Largest Root	.000	.008[b]	1.000	50.000	.928	.000
Time * Group	Pillai's Trace	.184	11.291[b]	1.000	50.000	.001	.184
	Wilks' Lambda	.816	11.291[b]	1.000	50.000	.001	.184
	Hotelling's Trace	.226	11.291[b]	1.000	50.000	.001	.184
	Roy's Largest Root	.226	11.291[b]	1.000	50.000	.001	.184

a. Design: Intercept + Age + Group

Within Subjects Design: Time

b. Exact statistic

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	32.560	1	32.560	14.743	.000	.228
	Greenhouse-Geisser	32.560	1.000	32.560	14.743	.000	.228
	Huynh-Feldt	32.560	1.000	32.560	14.743	.000	.228
	Lower-bound	32.560	1.000	32.560	14.743	.000	.228
Time * Age	Sphericity Assumed	.018	1	.018	.008	.928	.000
	Greenhouse-Geisser	.018	1.000	.018	.008	.928	.000
	Huynh-Feldt	.018	1.000	.018	.008	.928	.000
	Lower-bound	.018	1.000	.018	.008	.928	.000
Time * Group	Sphericity Assumed	24.936	1	24.936	11.291	.001	.184
	Greenhouse-Geisser	24.936	1.000	24.936	11.291	.001	.184
	Huynh-Feldt	24.936	1.000	24.936	11.291	.001	.184
	Lower-bound	24.936	1.000	24.936	11.291	.001	.184
Error(Time)	Sphericity Assumed	110.429	50	2.209			
	Greenhouse-Geisser	110.429	50.000	2.209			
	Huynh-Feldt	110.429	50.000	2.209			
	Lower-bound	110.429	50.000	2.209			

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Total Raw Score of the pretest	.660	1	51	.420
Total Raw Score of the posttest	2.619	1	51	.112

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Age + Group

Within Subjects Design: Time

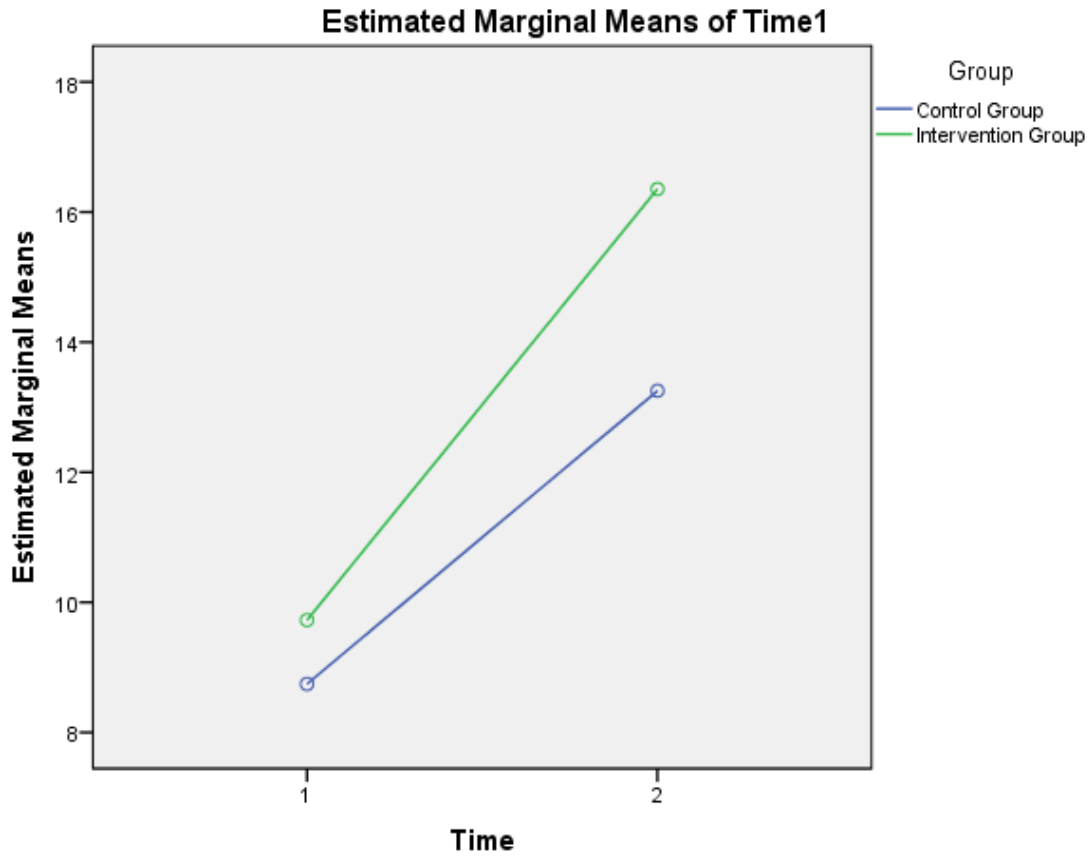
Estimated Marginal Means

3. Group * Time

Measure: Time1

Group	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control Group	1	8.745[a]	.932	6.873	10.617
	2	13.252[a]	.686	11.875	14.630
Intervention Group	1	9.726[a]	.951	7.815	11.637
	2	16.353[a]	.700	14.948	17.759

a. Covariates appearing in the model are evaluated at the following values: Age = 11.02.



Covariates appearing in the model are evaluated at the following values: Age = 11.02

Appendix 15: Attitude to Mathematics -Statistics

Normality testing on the variable of attitudinal scores (Skewness & Kurtosis)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Total Pre- score of Maths tset	53	2	23	9.23	5.941	.659	.327	-.651-	.644
Total Post-scores of Maths test	53	5	24	14.77	5.560	-.135-	.327	-1.165-	.644
Valid N (listwise)	53								

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total Pre- Attitude to Math	.128	53	.030	.942	53	.012
Total Post- Attitude to Math	.175	53	.000	.910	53	.001

a. Lilliefors Significance Correction

Mixed between-within subjects ANCOVA

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

Time	Dependent Variable
1	TotalPreAttitMath
2	TotalPostAttitMath

Between-Subjects Factors

		Value Label	N
Group	1	Control Group	27
	2	Intervention Group	26

Descriptive Statistics

	Group	Mean	Std. Deviation	N
Total Pre- Attitude to Math	Control Group	25.48	5.236	27
	Intervention Group	24.23	5.094	26
	Total	24.87	5.155	53
Total Post- Attitude to Math	Control Group	26.52	4.933	27
	Intervention Group	32.38	2.593	26
	Total	29.40	4.916	53

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.064	3.400[b]	1.000	50.000	.071	.064
	Wilks' Lambda	.936	3.400[b]	1.000	50.000	.071	.064
	Hotelling's Trace	.068	3.400[b]	1.000	50.000	.071	.064
	Roy's Largest Root	.068	3.400[b]	1.000	50.000	.071	.064
Time * Age	Pillai's Trace	.003	.128[b]	1.000	50.000	.722	.003
	Wilks' Lambda	.997	.128[b]	1.000	50.000	.722	.003
	Hotelling's Trace	.003	.128[b]	1.000	50.000	.722	.003
	Roy's Largest Root	.003	.128[b]	1.000	50.000	.722	.003
Time * Group	Pillai's Trace	.552	61.698[b]	1.000	50.000	.000	.552
	Wilks' Lambda	.448	61.698[b]	1.000	50.000	.000	.552
	Hotelling's Trace	1.234	61.698[b]	1.000	50.000	.000	.552
	Roy's Largest Root	1.234	61.698[b]	1.000	50.000	.000	.552

a. Design: Intercept + Age + Group

Within Subjects Design: Time

b. Exact statistic

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	14.933	1	14.933	3.400	.071	.064
	Greenhouse-Geisser	14.933	1.000	14.933	3.400	.071	.064
	Huynh-Feldt	14.933	1.000	14.933	3.400	.071	.064
	Lower-bound	14.933	1.000	14.933	3.400	.071	.064
Time * Age	Sphericity Assumed	.564	1	.564	.128	.722	.003
	Greenhouse-Geisser	.564	1.000	.564	.128	.722	.003
	Huynh-Feldt	.564	1.000	.564	.128	.722	.003
	Lower-bound	.564	1.000	.564	.128	.722	.003
Time * Group	Sphericity Assumed	270.989	1	270.989	61.698	.000	.552
	Greenhouse-Geisser	270.989	1.000	270.989	61.698	.000	.552
	Huynh-Feldt	270.989	1.000	270.989	61.698	.000	.552
	Lower-bound	270.989	1.000	270.989	61.698	.000	.552
Error(Time)	Sphericity Assumed	219.610	50	4.392			
	Greenhouse-Geisser	219.610	50.000	4.392			
	Huynh-Feldt	219.610	50.000	4.392			
	Lower-bound	219.610	50.000	4.392			

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Total Pre- Attitude to Math	.114	1	51	.737
Total Post- Attitude to Math	13.276	1	51	.001

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Age + Group

Within Subjects Design: Time

Estimated Marginal Means

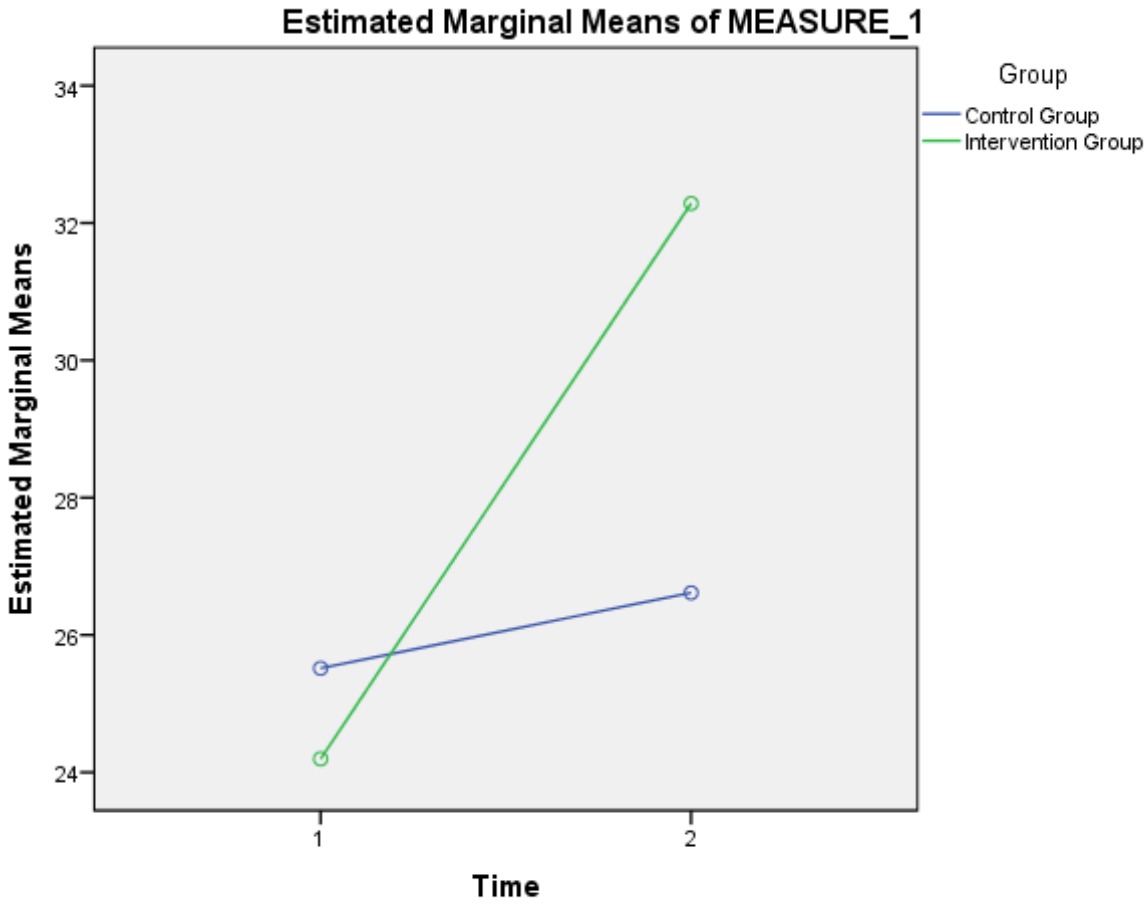
3. Group * Time

Measure: MEASURE_1

Group	Time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control Group	1	25.515[a]	1.051	23.405	27.625
	2	26.615[a]	.805	24.999	28.231
Intervention Group	1	24.196[a]	1.072	22.042	26.350
	2	32.284[a]	.821	30.635	33.934

a. Covariates appearing in the model are evaluated at the following values: Age = 11.02.

Profile Plots



Covariates appearing in the model are evaluated at the following values: Age = 11.02

Appendix 16: Example of an Interview's Transcript

Interview 1: Abeer

Math PALS Intervention:

Q 1: Can you describe PALS in math for me as you see it?

- It is one of the peer tutoring strategies where every child is responsible for tutoring another pupil in the classroom … In so doing, one assumes the role of the tutor while the other acts out as a tutee and then they switch roles. This includes exercises and activities sheets in mathematics in the form of some stimulating and fun games for the students to work on … These activities should not be used to explain a new concept in maths, but they can be taken advantage of after the teacher finishes her explanation as a practice or revision on the concept already covered in the lesson … Students have to work in pairs in order to solve these activities, and the student who has better maths ability starts first as a tutor, while the other student who has lesser ability will have to be the tutee … They both need to work together according to some specific guidelines and then switch roles at some point ... The teacher can adopt this strategy to monitor her students and their performance levels and to identify the strengths and weaknesses of each student in the arithmetic skills.

Q 2: What do you see as key principles/components of the programme?

- Some of the key principles are related to PALS rules, how to engage in pair work, as well as the roles and responsibilities of the tutor and the tutee … It is important that all students understand and absorb these principles well and know how to apply them without help … When a teacher divides her students into small groups to engage them in pair work, she needs to take into account several factors … For example, she can have two students with incompatible abilities … In other words, a high performing vs a low performing student … I would also try to find a balance between their characters because I think if they have opposing personalities, they will not be on the same wavelength and will not accommodate each other … The other important factor is that they should know when to switch roles ... The teacher is also required to ensure the students are self-dependent and her role will simply be restricted to offering guidance and supervision … She has to make extra efforts striving to train them to work independently … The principle of reinforcement and encouragement is also very

important for the students through the teacher's use of smiley faces, as well as providing extra support on the effective implementation of the PALS steps.

Q 3: Do you see Math PALS as a supplement or a substitute? Type equation here.

- Based on my experience with the students, I use it as a supplement and was never actually reliant on it … My role as a teacher is really important … Once I go through the lesson with my students, they soon get engaged with the PALS activity sheets and review the lesson with each other.

Q 4: How do you compare PALS with the other teaching strategies you have done during your teaching placement? Is there a conflict between the PALS strategy and other methods? *

- Mm … For example, I did use the discussion and dialogue method, but in comparison with the PALS, I feel the latter is better because the students cannot wait to play and always ask me when the PALS session will take place … Whenever we have a session, they always look very happy and give their opinion about the activity … For example, they would say "Look! These fingers indicate the number 3" … The exercise urges these students to interact with each other … Therefore, I found out it creates an environment of interaction and dialogue among them more than it does in the discussion method ... I think they seemed to enjoy playing the role of the tutor … In fact, they feel they have a role to play by explaining to each other and providing assistance and reinforcement for each other in colouring the smiley faces … I saw how much the students enjoyed the PALS activities, which made me feel it is a better method than any other style I used in teaching … This is also because students enjoy learning using educational play, which is an advantage found in PALS … Regarding your question on whether PALS conflicts with other teaching methods, in my opinion, it never does.

Strengths (of what you learnt to do by using PALS for Math)

Q 5: What do you see as the major strengths of PALS for your situation?

- To start with, the program is simple and well-organised, with clear strategies and guidelines … I did not really make so much of an effort to prepare for the PALS session as everything is clearly explained and detailed for the teacher, including the day-to-day student training sessions which are described in the teacher manual … Also, the PALS activities sheets are prepared beforehand and offer a variety of

exercises covering mathematic concepts … The teacher simply has to choose what fits with the lesson and abilities of the students and also the e- PALS activities are adjustable so for example you can change the numbers, addition, subtraction, you can also change the place value and missing addends. … I also liked the simple and clear PALS rules because they were made easy for the students to understand and absorb quicker.

- For the students, everything was clear according to specific steps … The same applies to the program which was flowing, easy, light and fun … I think these are the stronger points … The steps of the program are not that complex as the students have only to follow the rules and use the PALS sheets.

Q5a: Which parts do you like best?

Q5b: Which parts do your students like best?

- For me, I like the fun created by PALS in the classroom in terms of the interaction between the students … They are now working with each other, with each student giving some sort of tutoring to another peer and providing feedback, in addition to reinforcing and tracking the correction procedure … All I do is just monitoring and supervise them.

- The part I felt the students preferred most is role play … they prefer to play the role of the teacher.

Q 6: What was most helpful way about the way the PALS researcher trained and worked with you?

- What has been shown at the lecture and workshop, especially role-playing helped in terms of understanding the strategy more quickly … We carried out the strategy and PALS materials with each other the same as we do in the classroom and kept observing each other … We experimented with various roles, including the teacher's role and the tutor's and the tutee's … We also experimented with the materials and folders and how to use them, as well as video presentation … In addition, we worked together to summarise the PALS steps on colourful posters ... Also, the manual included a detailed explanation and was extremely helpful … Another aspect is the guidance and support during the application stage, especially in the first few weeks … We held a small group discussion to raise questions and deal with any difficulties encountered in the students training and feedback to enhance the application process.

Q 7: What do you think of PALS influence for students? For teachers?

- For me, I honestly enjoyed it very much and learnt quite a few things and added it to my academic and hands-on experience in a strategy that has never been used in Saudi Arabia … I was actually among the first to have applied it with her students in our country … Hopefully, once I become a teacher, I will put it into practice … It will not be confined to mathematics, but might be other subjects … I might use it with reading or spelling … I trained my students to explain to each other, this experience will make using PALS method easy for me when I start my teaching career and will give me a bit of rest during the lesson … At the same time, it will develop the students' personalities.

- For the students, I feel that it helped them develop their social skills and increase their self-confidence … For example, when one of my students assumes the teacher's role, I can see an emotional change in the tone of her voice and a feeling of joy … This can have a major positive impact on her as a leader ... Ranim and Nora are two students in one of my classes who always argue and never seemed to get along … Once I introduced group work in PALS, they became less argumentative and the ill feelings disappeared … I started using the PALS as an incentive by telling students they will be allowed to work on PALS if they do not argue … I had another student Saima who was very clever but her problem was lack of attendance … She is actually the quietest of all students, and this made her keep her distance from the noisier classmate... When we started PALS, the school psychologist and I noticed that her attendance improved drastically ... She was always keen to know about the following PALS sessions, and whenever we had one planned, I could see that she was very pleased … The psychologist attended one of my PALS sessions and she told me that Saima's mother called her and she was excited to see that her daughter Saima has been going to school nearly every day, the psychologist informed Saima's mother that her daughter had a better attendance record and that she likes the PALS activities … When the psychologist attended the PALS session and I explained for her how the programme works, she loved it so much and kept enquiring about when it would be implemented in school ... Saima's reaction to the program is the most notable among all students.

- I also noticed that low performing maths students improved their performance a great deal ... I also noted that by assuming the role of the teacher, students were empowered to enhance their performance in the same skill … For example, Nora always made

mistakes when pointing to numbers with her fingers, but when she started doing the teacher's role for a number of times, I noticed that she became more accurate and used her fingers correctly when asked by Ranim … This way, information could be instilled a lot more effectively.

Weaknesses and Limitations

Q 8: Some people have this view about PALS: "peer training and monitoring require additional planning time and effort on the part of the teachers, which is frustrating because it might increase the teacher's responsibilities". What do you think? *

- I do not think there is any effort … On the contrary, it slightly eases off the pressure on the teacher's shoulder and give her some time to rest during the lesson after the students have mastered the activities in the PALS groups ... I find it easier than the traditional teaching method as it is always left to me to do all the talking and it is also exhausting ... I think the process of training the students on how to use the program in the first few weeks was very difficult and took a lot of effort and time, and was energy sapping, to be honest … But soon after, it became easy and less demanding … It took me such a long time to train my students on the correct procedures … For example, the tutor has to wait for a few seconds to allow the tutee ample time to think about the correct answer … If the tutee fails to provide the appropriate answer, then the tutor has to explain how to arrive at the answer and not jump straight to the answer … It is a slow and patient build-up to help classmates identify the answer … I was honestly surprised because I have never imagined it could have such a pleasant impact … I am truly impressed … It is definitely an excellent program because it allows the tutoring students to become young teachers and convey information to their peers in their own preferable way … I have honestly enjoyed it.

Q 9: Have you seen anything in your experience of PALS in your teaching practice, that you think might make it harder or easier for you to adopt this strategy? Or, do you feel that PALS might not fit in very well with our local context? *

- I wish I could add in the same PALS Rules board an image of a flag to refer to the time tutor and tutee swop roles, as well as a smiley face pointing to the time for reinforcement ... This would make it easy for them as they would be able to notice it in the rules board ... I did however place as you might have noticed a symbol of a flag and a smiley face near the rules board as a reminder for students ... I do not think there is something too difficult to apply … I do not also think that it does not fit with the

maths skills of our female students since it is a curricular requirement to know about addition and subtraction.

Q 10: What limitation or weaknesses do you see on the original way you were trained to use math PALS programme? Have you made any attempts to do anything about these weaknesses?

- I think everything was clearly organised and written in detail … The principal and supervisory staff from the university also offered the program unlimited follow-up, support and encouragement.

Q 11: Any thoughts about better ways for researcher to work with teachers?

- I hope there is a video dealing with the application of PALS by Saudi children with special educational needs … This can be used as a hands-on example.

- I am really keen on this program and I like the whole idea … My sister is now a Year 2 primary school teacher in the public education … She has a class-management problem being unable to control her misbehaving students … She once complained that the time allocated for the lesson would be wasted trying to get them organised and as soon as she was about to start, there is hardly any time left for teaching … I proposed the PALS strategy and provided her with some materials, and she welcomed the idea … In fact, she started applying it in her own class, switching roles and using smileys … She also ensured high performing students would tutor low performing classmates… my sister said that parents, however, complained that she would leave distinguished students to teach their peers … But I think the reason is that my sister did not apply it properly.

Wrap-Up

Q 12: Looking to the future, would you like to use the PALS strategy to teach math when you become a teacher? Why? Why not? *

- Yes, I will use the strategy when I become a teacher because the program is clear to be honest… I do really like it because I did not find it too difficult … In fact, I had so much fun with my students during the application stage, and it has helped me organise the classroom, as well as increasing the focus and attention of my students and making them work together on a specific activity without being distracted.

Q 13: Can you summarise for me where you see yourself right now in relation to the use of PALS for mathematics?

- I really enjoyed it … I feel I have perfected it and capable of applying it again and training the students on how to use it.

Q 14: Is there anything else you would like to say?

- I would like to thank you for offering us this opportunity and we apologise if we could not be of help with anything.

Appendix 17: Example of the initial coding for thematic analysis which were generated with the interviews

Interview 1: Abeer

Q 7: What do you think of PALS influence for students? For teachers?

- For me, I honestly enjoyed it very much and learnt quite a few things and added it to my academic and hands-on experience in a strategy that has never been used in Saudi Arabia … I was actually among the first to have applied it with her students in our country … Hopefully, once I become a teacher, I will put it into practice … It will not be confined to mathematics, but might be other subjects … I might use it with reading or spelling … I trained my students to explain to each other, this experience will make using PALS method easy for me when I start my teaching career and will give me a bit of rest during the lesson … At the same time, it will develop the students' personalities.
- For the students, I feel that it helped them develop their social skills and increase their self-confidence … For example, when one of my students assumes the teacher's role, I can see an emotional change in the tone of her voice and a feeling of joy … This can have a major positive impact on her as a leader ... Ranim and Nora are two students in one of my classes who always argue and never seemed to get along … Once I introduced group work in PALS, they became less argumentative and the ill feelings disappeared … I started using the PALS as an incentive by telling students they will be allowed to work on PALS if they do not argue … I had another student Saima who was very clever but her problem was lack of attendance … She is actually the quietest of all students, and this made her keep her distance from the noisier classmate... When we started PALS, the school psychologist and I noticed that her attendance improved drastically ... She was always keen to know about the following PALS sessions, and whenever we had one planned, I could see that she was very pleased … The psychologist attended one of my PALS sessions and she told me that Saima's mother called her and she was excited to see that her daughter Saima has been going to school nearly every day, the psychologist informed

Commented [Naeema1]: Main theme: Positive impact on participant practitioners
Sub theme: enjoyment

Commented [Naeema2]: Main theme: Positive impact on participant practitioners
Sub theme: learning new method to add to previous experience

Commented [Naeema3]: Main theme: Future use
Sub theme: Plan to apply it when becoming a teacher

Commented [Naeema4]: Main theme: Future use
Sub theme: benefit from PALS in other subject areas

Commented [Naeema5]: Main theme: positive impact on participant practitioners
Sub theme: easing the pressure on practitioners

Commented [Naeema6]: Main theme: Student outcomes
Sub theme: Social skills

Commented [Naeema7]: Main theme: Student outcomes
Sub theme: Self confidence

Commented [Naeema8]: Main theme: Positive elements of PALS
Sub theme: enjoyment

Commented [Naeema9]: Mine theme: student outcomes
Sub theme: peer relationships (Cases)

Commented [Naeema10]: Main theme: student outcomes
Sub theme: positive attendance

Commented [Naeema11]: Main theme: Positive elements of PALS
Sub theme: motivational approach for students(cases)

Appendix 18: Example of Organising Initial Codes on Data Drawn from Interviews

Themes from the research questions:

1. Gains from teaching participants having undertaken a preparatory peer tutoring course
1. Implementation of peer tutoring programme
2. Teaching participants' perceptions of the peer tutoring programme
3. Improvements in student knowledge/performance
4. Impact of peer tutoring programme on students' attitudes towards mathematics

Coding Key:

I = Interview Number Q = Question Number

The main themes are highlighted in yellow and the sub themes are highlighted in green. The 5 themes then make up the headings highlighted in yellow in the tables. The sub themes make up the vertical headings in the tables, these are highlighted in green. I have then filled the table with quotes and indicated where that particular theme and sub theme is present from the interview data. So, I1, Q2 means that that particular sub theme appears in interview 1, question 2

Gains	
Initial.	The preparatory course, particularly the role-playing aspect (adopting the role of teacher, pupil tutor and pupil tutee) helped in terms of understanding the strategy more quickly and the materials involved. Experimentation in the various roles have allowed a greater understanding of their use, which was supplemented by the video presentation. The designing of colourful posters about the PALS steps were also of great benefit I1, Q7. Detailed manual, extremely helpful I1, Q7; I3, Q7 The training course, including its practical aspect was useful and the manual and additional materials provided clear and detailed explanation about the application of the programme. I was able to read it quietly at home, carry out reviews and checks in addition to the help provided by the programme supervisor I2, Q7. Training course, inclusive of videos, were extremely helpful I3, Q7. Workshop and hands-on training was enjoyable, clear and understandable; the explanation, presentation and videos were really helpful, as were the resources used inclusive of folders, materials and posters for PALS rules. Working together as we would in a classroom made things easier for us I4, Q7. Clear, comprehensive workshops enabled me to really enjoy the programme. Materials (videos, slides and manual were useful and well explained I5, Q7, I5, Q11.

Application Stage.	Guidance and support were provided, especially in the first few weeks; group discussions were held to raise questions and deal with difficulties encountered I1, Q7. Guidance, feedback and follow-up from the programme supervisor and visiting tutors was helpful I2, Q7. Videos, slides and manual were useful and were frequently referred to when engaged in the application process I5, Q7.
Implementation	
Games:	I1, Q1; I3, Q1. Based on the idea of game play I3, Q3; I3, Q6; I5, Q4; I5, Q10 (future development).
Paired Work:	I1, Q1; I3, Q2; I3, Q6; I4, Q1; I5, Q1; I5, Q2; I5, Q5a; I5, Q8.
Understanding of Principles	Following guidelines to work together and switching roles I1, Q1; I1, Q2; I4, Q1; I5, Q1; I5, Q2. Social interaction between children I2, Q2; I3, Q6; I4, Q4; I5, Q1; I5, Q9. Development of social skills I2, Q5; I3, Q4; I4, Q4; I4, Q8; I5, Q8; I5, Q9. Caring for each other I2, Q8, I3, Q6; I5, Q5a; I5, Q8; I5, Q9. Application of PALS rules I4, Q2; I4, Q8.

	Understanding roles I2, Q4; I3, Q1; I3, Q2; I4, Q2. One child being tutored by another using pre-planned/organised activities in mathematical skills I3, Q1; I4, Q1. Being organised I4, Q8.
Self-dependence	I1, Q2; Capable and happy I4, Q5. Sense of satisfaction I2, Q4. Development of new skills I3, Q4. Improved communication I5, Q5a; I5, Q9. Teaching students to rely on themselves I5, Q6.
Roles.	Interchangeable roles I1, Q1; I5, Q2. Learning how to tutor I2, Q2; learning how to explain things to each other I2, Q5, I4, Q8 (examples provided in the transcript); I5, Q1. Knowing the responsibilities of each role I2, Q2: I3, Q1; I3, Q2; I4, Q2. Understanding roles I2, Q4; I4, Q2.

	Respect for roles - waiting for partner to develop answers and use before engaging in conversation I2, Q5; I3, Q4; I4, Q2. Role play where one assumes the role of captain while the other is being led, then switch roles I4, Q1; I4, Q2. Mutual trust I5, Q1.
Tutor/Tutee.	More able pupil as tutor in first instance I1, Q1; I4, Q2; I5, Q2. Teaching specific skills to their peer then switching roles following specific rules I2, Q1; I3, Q2; I5, Q2. Learning how to tutor, use correction procedures I2, Q2; I4, Q2; I4, Q8 (examples provided in the transcript); I5, Q1; I5, Q2. Respect for roles - waiting for partner to develop answers and use before engaging in conversation I2, Q5; I3, Q4 (examples provided in transcript); I4, Q2. One of the pupils undertaking to do some teaching to one of his peers I4, Q1; I5, Q1. Mutual care (examples provided in the transcript) I5, Q9.
Monitoring/Assessment/Feedback.	I1, Q1; I2, Q2, I3, Q2; I5, Q2.
Revision/Understanding.	I1, Q1.

Role of Participant Practitioner:	Supervision, guidance, feedback I1, Q2; I1 Q6; I3, Q1; I4, Q2; I5, Q1; I5, Q2; I5, Q5a; I5, Q9. Reinforcement I1, Q2; I2, Q2; I3, Q2; I4, Q2; I5, Q2. Organisation of PALS folders, activities and materials I3, Q2; I4, Q2; I5, Q2.
Organisation of working partners	Mixed abilities, compatible characters I1, Q2; I1, Q8; Counting ability of children, their maths skills and the chemistry between them I4, Q2.
Organisation of rewards/reinforcement	Smiley faces I1, Q2; I3, Q2; I4, Q2; I4, Q5; I5, Q2; I5, Q6.

Perceptions	
Pupil as Tutor:	
Enjoyment	Enjoy the role of tutor I1, Q4; I1, Q8; I2, Q4; I3, Q6 Element of education play I1, Q4; I3, Q4. Learn maths through play and interaction I2, Q1;

	Interacting with each other and chatting more often about numbers I2, Q5; I4, Q8 (examples provided in the transcript). Beneficial in terms of time management and making maths lessons very enjoyable I2, Q9. Cooperative learning I3, Q4. Development of new skills I3, Q4. Working together I4, Q4. Capable and happy I4, Q5.
Reinforcement	Provide assistance and reinforcement to their peers I1, Q4; I1, Q8; I2, Q4; I3, Q6 Rewards/reinforcement I2, Q2, I2, Q4; I3, Q2; I4, Q2; I5, Q6; I5, Q9.
Pupil as Tutee.	Knowing the responsibilities of each role I2, Q2; I3, Q2. Respect for roles - waiting for partner to develop answers and use before engaging in conversation I2, Q5; I3, Q4; I4, Q2. Development of new skills I3, Q4.

Supplement/Substitute.	Supplements to normal teaching role I1, Q3; I2, Q3; I3, Q3; I4, Q3; I5, Q3.
Engagement:	
Fun	Specific steps which make the programme flow well, making it easy, light and fun I1, Q5; I1, Q8 (examples given in transcript) The fun created by PALS in the classroom as a result of the interaction of the students I1, Q6; I1, Q8 (examples given in transcript); I3, Q6; I3, Q13; I4, Q8 (examples provided in the transcript). We had great fun and enjoyed the interaction of the children and their enjoyment I4, Q12. Excitement I5, Q5a. Laughter I5, Q8. Atmosphere in the classroom I5, Q13.
Interaction	Encourages student interaction and dialogue I1, Q4; I1, Q8 (examples given in transcript); I2, Q2; I2, Q4; I2, Q5; I4, Q8 (examples provided in the transcript). Supportive interaction in role as tutor I1, Q8; I2, Q4; I4, Q8 (examples provided in the transcript).

	Learn through play and interaction I2, Q1; I4, Q12. Encouragement through rewards and praise frequency and/or clapping I2, Q4. Structured PALS offers added advantage that it encourages and supports interaction and develops a skill often absent in those who have SEN I2, Q4. Provides motivation I2, Q4; I5, Q1; I5, Q4; I5, Q5. Development of new skills in terms of being able to formulate their own ideas but also in being able to explain them properly through interaction I3, Q4. Interaction improving relationships I3, Q6; I4, Q4; I4, Q8 (examples provided in the transcript); I5, Q8 (examples provided in the transcript). Getting to know each other I4, Q4, I5, Q8; I5, Q9. Improved communication I5, Q5a; I5, Q9.	
Strengths:	Likes: Simple, well organised, clear strategy and guidance, easy to implement, variety of exercises I1, Q5; I2, Q11; I3, Q6	Positive Influence: Clarity for students to aid understanding; simple, specific steps which make the programme flow well, making it easy to follow, light and fun I1, Q2.

	The fun created by PALS in the classroom as a result of the interaction of the students; increased ability to cooperate with each other and greater confidence when adopting the role of the tutor I1, Q6. The programme takes the pressure off the teachers' shoulders once the initial training of the students is completed with regard to its proper processes (examples given in transcript) I1, Q9; I3, Q6	Development of social skills and self-confidence - detailed examples provided in transcript I1, Q8; I3, Q6. Positive impact upon student attitudes I1, Q8 Positive impact upon attendance I1, Q8 Teaching Participants: enjoyed the process, feeling that this method of working has provided them with an additional pedagogical approach which has not been used in Saudi Arabia before. Comment was made that this strategy could be useful in other areas, for instance when reading the Quran I1, Q8. Enjoyable experience. Impressed by the impact that it has had on students' ability to communicate with each other

	Keen on using this programme - it would appear to be particularly useful as a class management tool I1, Q12. Holistic approach, allowing pupils to practice what they have learnt through PALS I2, Q4. Improvement in student academic outcomes, better learners in terms of addition and subtraction knowledge, the use of counting tools, respect for and development of teacher/tutee roles, enhanced ability to interact and work in small groups, the development of social skills (allowing for partners to complete answers before engaging in conversation and not interrupting) I2, Q5. Best thing about the programme is students explaining things to each other; they liked the use of smiley faces and	and impart information to their peers in their own language I1, Q9. After the initial period, the experience was enjoyable and easy to administer I2, Q4. Enjoyable programme. Arguably the best aspect is that they explain things to their peers; students were happy and motivated when partners use smiley faces to reinforce learning, something which was previously reserved only for teachers I2, Q6. Real pride - the Head Teacher's positive comments with regard to the positive change in behaviour of students and how well they interacted during group sessions; she was 'well pleased' with my efforts; I am happy having learnt a new teaching method which will be a great addition to my personal CV;

	their learning being reinforced by their partners - this motivating them and made them happy I2, Q5. Improved their maths skills (examples provided in the transcript), increased self-confidence and better overall social skills (examples provided in transcript) I2, Q8. Beneficial in terms of time management making the maths lesson very enjoyable I2, Q9. Materials easily accessible, particularly for SEN students I2, Q10. Enjoyed learning through play and collaborative learning I3, Q4. Greater levels of self-confidence in students, as well as developing social and new skills I3, Q4; I3, Q6	children are provided with excellent opportunities to learn through interaction, skills which were transferable to reading and Quran classes I2, Q8. Greater levels of self-confidence in students, as well as developing social and new skills I3, Q4; I3, Q6; I3, Q8.

	Development of new skills in terms of being able to formulate their own ideas but also in being able to explain them properly I3, Q4. Interaction and discussion I3, Q4; I4, Q8 (examples provided in the transcript). Fun for children because they like gameplay I3, Q6. Improved maths levels I2, Q5; I2, Q8; I3, Q6; I4, Q4; I4, Q13. Improved relationships (examples provided in transcript) I3, Q6; I4, Q8 (examples provided in the transcript); I5, Q5a. Novel, fun based idea which allows students to develop new skills through attempting to do things they have not had opportunities to do before I3, Q6.	Development of new skills in terms of being able to formulate their own ideas but also in being able to explain them properly I3, Q4. Interaction and discussion I3, Q4; I4, Q8 (examples provided in the transcript). Improved maths levels I2, Q5; I2, Q8; I3, Q6; I4, Q4; I4, Q8 (examples provided in the transcript); I4, Q13. Improved relationships (examples provided in transcript) I3, Q6; I4, Q8 (examples provided in the transcript); I5, Q5a. Different from the traditional approach, provides students with opportunities to

	After initial stages, no additional workload for practitioners I3, Q9. Playing together and getting to know each other I4, Q4. Everything there - materials, manual - teachers only have to choose suitable levels for the children prior to applying the programme. An interesting method of teaching and learning. Realised how capable and happy children work to be engaged in peer tutoring. I4, Q5 Teachers who observed were full of praise for the children's interactions and	interact with each other and develop new skills I3, Q6. Happy for students as their maths has improved; personal success, which although difficult at first, soon became fun - a useful tool with which I have gained experience and a new teaching method I3, Q8. Motivational and fun for students I3, Q13. Positive impact on classroom atmosphere I3, Q13; I4, Q5; I5, Q1; I5, Q5a. The positive impact that PALS had on children in terms of their academic and social progress made me try to apply the idea to reading, following the same structure and pattern. The children enjoyed working together and I feel that if this strategy were applied in reading it

	the materials; folders are useful for children as it teaches them how to be organised and provides them with a degree of success in a short period of time I4, Q5. Smiley faces a source of motivation I4, Q4. Positive atmosphere I4, Q5; I5, Q8. Materials and manual, smiley faces and pupils acting as leaders I4, Q6.	would have a positive impact and be very effective. I did not continue with this because the preparation of reading materials and activities requires time and effort as they are not prepared in advance, as with the PALS maths activities I4, Q4. Teachers who observed were full of praise for the children's interactions and the materials; folders are useful for children as it teaches them how to be organised and provides them with a degree of success in a short period of time I4, Q5. Smiley faces a source of motivation I4, Q4. Pupils acting as leaders I4, Q6. Motivational, additional assets in teaching and instruction in making it easy for students to understand

	After the initial period, the process became easy and there was no longer effort required … 'On the contrary, the maths lesson became more enjoyable than ever before' I4, Q9. Materials, especially the ones containing pictures, were useful and make the job easier I4, Q10. I had to resort to role-play, wearing clothing of cartoon characters for the students to help in their understanding of the application of PALS strategies -	concepts. Useful in terms of providing pupils with the right training and exploring different strategies as well as being able to progress from prompting to using hints and then gradual concealment, helping them towards working independently and developing both listening and observation skills I4, Q8a. Grown in confidence as a teacher through the experience of knowing when to hold back and give students a chance to try. Feedback from teachers and the school principal made me feel proud. I enjoyed the experience I4, Q8a.

	we had great fun and enjoyed the interaction of the children and their enjoyment I4, Q12. Enjoyed the training and experimentation with different methods of teaching; helped to improve my teaching skills and the time I dedicated for learning and applying the programme paid off I4, Q14. Motivated by improvements in student performance I4, Q14. Less workload (explanation provided in I5, Q5a); motivation for learning and enthusiasm to be part of the class I5, Q5.	Enjoyed the training and experimentation with different methods of teaching; helped to improve my teaching skills and the time I dedicated for learning and applying the programme paid off I4, Q14. Mutual trust I5, Q1.

	Teaches students to rely on themselves in terms of their organisation; they were fully engaged without any assistance. I5, Q6. Maths activity sheets which offered variety and made it easy for the selection of activities commensurate to student abilities without any extra effort on my part I5, Q6.	Motivation for learning and enthusiasm to be part of the class I5, Q5. I felt keen when preparing the PALS activities and watching the students do them - I love what I do and this makes me feel happy with my performance in the classroom. Students become close to one another and more respectful and considerate towards each other; it developed better communication skills and self-confidence as a result of the paired work and collaboration. They are no longer afraid to make mistakes which is a tremendous achievement for them I5, Q5a. Teaches students to rely on themselves in terms of their organisation; they were fully engaged without any assistance. I5, Q6.

	Old and new sections of the folder, smiley faces, activities with drawings, role-play and rewards I5, Q6. Easy to apply the programme; materials were very useful and well explained I5, Q7. Once the initial training was completed, its application was easy and not too time-consuming, allowing teachers to	Old and new sections of the folder, smiley faces, activities with drawings, role-play and rewards I5, Q6. Students less selfish (examples provided in the transcript), more interested and engaged (example provided in the transcript). The programme has also improved the level of students' maths and self-esteem, whilst bringing them closer together (examples provided in the transcript). It has created 'a lovely atmosphere of familiarity and closeness' and developed their social skills I5, Q8. Felt pride and fulfilment at the end of the programme seeing how much students had improved in their maths

	improve students' maths levels. It is completely different from the traditional approach in which students are passive. This method allows students to be active, reduces teachers' workload to the extent that they are able to control and supervise children who are engaged in paired work activities. Developed students' social and communicative abilities (examples given in the transcript) I5, Q9. The programme was suitable for the students and was flexible enough that it could be used in moments of spare time which allowed them to be engaged in activities conducive to their education and skills development I5, Q10.	and social skills; PALS has helped me so much in terms of behaviour management in the classroom (examples given in the transcript) I5, Q8. Spare time utilised to the benefit of students' skills development I5, Q10. Behaviour I5, Q13.

		Successes of students ‘makes my day’ I5, Q13. This programme changed my perspective with regards to maths as a subject I5, Q14.
Weaknesses:	Dislikes/Limitations: Nothing. Everything was clearly organised and written in detail (echoed by I5, Q11); follow-up for the administration of the programme was unlimited both in terms of support and encouragement I1, Q11. Teaching Participants: initial application was difficult compared to other teaching strategies acquired at University;	Adjustments: Some form of indicator (image of a flag) to indicate the time for the tutor/tutee to swap roles I1, Q10. Training videos involving Saudi SEN children I1, Q12; videos involving SEN children in the classroom environment that draw on real cases I2, Q12; videos on how to apply the programme with

	difficulties arose in students not knowing PALS rules and in the time taken to induct students into the programme, as well as the initial lessons using the programme I2, Q4. Reading time and effort at the start of the programme, learning how to use the program whilst training students I2, Q9. Training the children was difficult in the first instance, in that SEN children would be taught things one day and not remember it the next, necessitating a repetition of the whole process; utilised different teaching methods such as role play I2, Q10. I became bored and disappointed as a result of the constant repetition with students although once the training had been absorbed, the whole process	SEN children in classrooms in a realistic learning situation I3, Q12

	became much easier and enjoyable I2, Q10. Time and effort at the beginning; training the children at the initial stages was difficult; management of group work was challenging in its initial stages I3, Q9. PALS strategy is quite good but only in the context of maths - I don't particularly like maths. This allied to the fact that children have to follow specific instructions and set routines in a mechanical way makes this unattractive for me. I want children to be given more freedom in terms of interacting with their peers and creating dialogue with others in the classroom in order to solve problems. Another issue for me is the	Development of an electronic cartoon game which can be integrated into IT provision I3, Q10.

	requirement to prepare children from the beginning and to retain those pairs for long periods - this was not popular with the students (example provided in the transcript) I4, Q4. Demanding for teachers - time-consuming in terms of training children in the first place and supervising their efforts when using the programme I4, Q4. Other teaching methods used do not require as much effort as PALS in providing training for children. Other methods provide more freedom for children to work in different ways and the teacher has freedom to diversify activities as necessary I4, Q4. It used to take up ‘so much of my time.’ It took extra effort in terms of organising things for individual students	

	and providing equal amounts of training for each individual (example provided in transcript with regard to specific individual). After the initial training period, the process became easier I4, Q9. This system is not that difficult, it is the students who make it difficult, depending upon their specific abilities - additional work is necessary in order to ensure that they have thoroughly absorbed the information. Generally, the materials were useful and make the job easier but those that did not come with pictures necessitated the provision of cubes, balls and sticks to help them with counting numbers. I4, Q10. Maths is a difficult subject (one on which I am not too keen) - if PALS was	Would have been better if the researcher had carried out the training with SEN children themselves - training sessions could also have been videoed for the researcher to show trainees I4, Q12. A cartoon example to explain the PALS concept would have been useful as an interactive aid to children's training I4, Q12.

	connected to reading, it would be far easier I4, Q10. Great effort at the start when students were provided with training on the programme - this effort is necessary or they would not be able to teach each other I5, Q9, I5, Q10.	It would benefit from the development of some form of electronic game utilising computer technology which would allow for educational game play, allowing for the whole program and its storage to be done via the computer (details provided in the transcript) I5, Q10.
Future Use.	Definitely use this programme - it is clear and straightforward to follow I1, Q13; - it is beneficial for students both academically and socially - it allows peers to explain things to each other (which often takes less time than it does for teachers) and removes barriers and perceptions about learning I2, Q13.	

	- motivational and fun for students I3, Q13. - colleagues exposed to this were keen to learn about it and to apply it in their classroom I3, Q14. - PALS help raise levels in numeracy skills, enhanced self-confidence and developed the social skills I4, Q13, I5, Q13. - Enhanced mathematical ability, as well as abilities to work together and care for each other - it allows students to have fun whilst learning in an interactive, enjoyable way I5, Q13. Fun to use with the students I1, Q13, I3, Q13; Helped with classroom organisation I1, Q13. Extend its use – I plan to speak to my other colleagues at University about my experiences and would like to give training and provide further assistance to those who are interested I2, Q15. Would like to see the subject of peer tutoring introduced from a philosophical and theoretical point of view and included in a course on teaching methods at University - it has been useful to apply this teaching method, having never realised its existence previously I3, Q15, I5, Q11. I would also like to see PALS in the reading module I3, Q15.

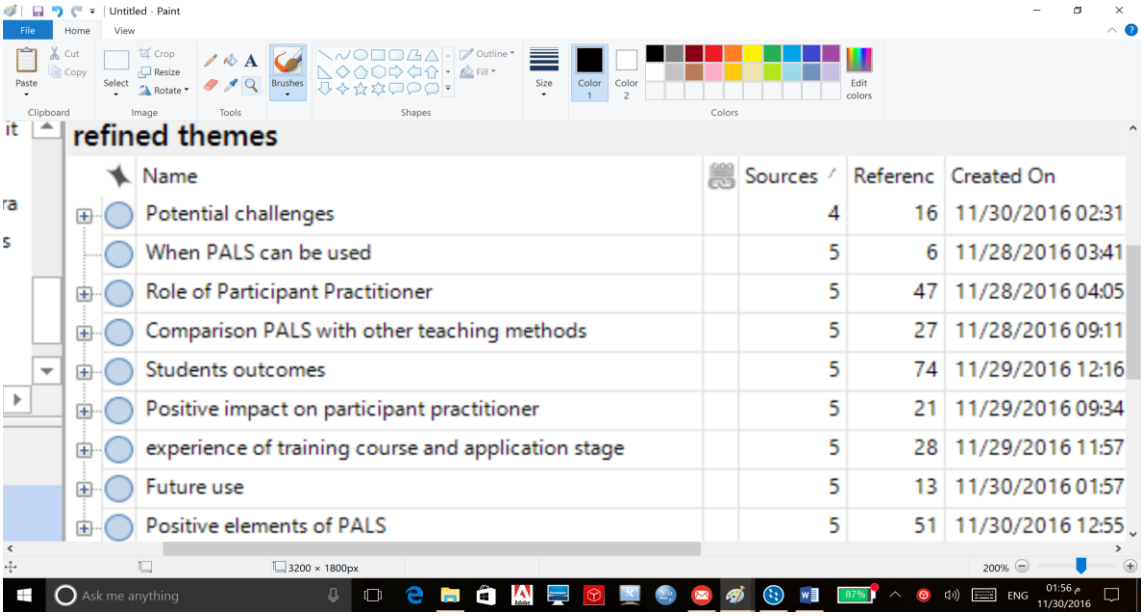
	Extend to use with reading activities I4, Q13. This programme completely changed my perspective with regard to maths I5, Q14.	
Conflict between PALS and other teaching strategies.	No conflict (discussion	- although PALS better than others used and dialogue methods), students enthusiastic about it I1, Q4. - have used collaborative learning, although PALS is more effective in enhancing mathematical performance I2, Q4. - students were enthusiastic, interacting well with PALS programme, responding better to these methods than traditional teaching methods I3, Q4. - collaborative learning involves students working together as a group with all of them contributing something to complete a task, commensurate with their abilities whereas PALS focuses on a specific skill that one of the students may not find it easy to understand or solve; the more knowledgeable student will endeavour to offer one of her peers some tutoring to help improve their performance and overcome difficulties with regard to a specific topic or issue I3, Q4. - cooperative learning is initially low maintenance in terms of training whereas PALS requires a

	substantial amount of input and training from the outset; eventually students become proficient with the techniques with a good deal of practice I3, Q4. - Cooperative education which I enjoyed as learning through play allows children the opportunity to interact and carry out required tasks; I also tried self-modelling and video modelling. I4, Q4. - Other teaching methods used do not require as much effort as PALS in providing training for children. Other methods provide more freedom for children to work in different ways and the teacher has freedom to diversify activities as necessary I4, Q4. - Previously used self-modelling, video modelling, discussion, dialogue and cooperative learning. PALS is a novel and comprehensive method which brought students to life, spurring their enthusiasm and motivation for learning; utilised gameplay - a complete package I5, Q4.
mprovements in student knowledge/performance	
Knowledge.	Assuming the role of the teacher allowed information to be learnt more effectively I1, Q8. Improved knowledge - addition and subtraction I2, Q5.

	- counting in general I3, Q8. Development of new skills in terms of being able to formulate their own ideas but also in being able to explain them properly I3, Q4.
Performance.	As a result of assuming the role of the teacher, students were empowered to enhance their performance in order to provide necessary guidance to the tutee I1, Q8; learning how to explain things to each other I2, Q5. Increased focus and attention I1, Q13. Cooperative working I1, Q13. Increased levels/skills I1, Q13; I3, Q6; I3, Q8; I4, Q4; I4, Q8; I4, Q13; I5, Q9; I5, Q13. Enhanced performance I2, Q4; I2, Q8 Enhanced motivation I2, Q4; I5, Q1; I5, Q4; I5, Q5. Enhanced academic outcomes in mathematics I2, Q5. Using tools to such as calculator, cubes, sticks I2, Q5; I3, Q8 Work well as a team I3, Q2. Development of new skills in terms of being able to formulate their own ideas but also in being able to explain them properly I3, Q4.

	Increased levels of self-confidence I3, Q4; I3, Q6; I3, Q8; I4, Q4; I4, Q13; I5, Q5a; I5, Q8; I5, Q9. Not afraid to make mistakes I5, Q5a.
Impact of peer tutoring programme on students' attitudes towards mathematics	
Focus and Attention	Increased levels/skills I1, Q13; I3, Q6; I3, Q8; I4, Q4; I4, Q8; I4, Q13; I5, Q9; I5, Q13. Work well as a team I3, Q2. Increased levels of self-confidence I3, Q4; I3, Q6; I3, Q8; I4, Q4; I4, Q13; I5, Q5a; I5, Q8; I5, Q9. Motivational and fun for students I3, Q13; I4, Q5; I5, Q4; I5, Q5. Positive atmosphere I4, Q5; I5, Q1; I5, Q8. Concentration I4, Q8.

Appendix 19: Example of Organising Refined Codes on Data Drawn from Interviews by NVivo



Main theme: Positive elements of PALS

Sub theme: cheerful atmosphere in the classroom

<Internals\\transcript 2, Amal> - § 1 reference coded [0.41% Coverage]

Reference 1 - 0.41% Coverage

- This creates a cheerful atmosphere in the classroom

<Internals\\Transcript 3, Abeer> - § 1 reference coded [1.23% Coverage]

Reference 1 - 1.23% Coverage

- Through the use of PALS, students can get to practise the role of the teacher for some time, and this can reflect positively on the atmosphere in the class.

<Internals\\Transcript 4, Afnan> - § 1 reference coded [0.67% Coverage]

Reference 1 - 0.67% Coverage

- Not to mention the smiley faces which are a source of motivation and create a positive atmosphere in the classroom.

<Internals\\Transcript 5, Nada> - § 4 references coded [2.93% Coverage]

Reference 1 - 0.34% Coverage

- it creates a really friendly and sociable atmosphere in the classroom

Reference 2 - 0.36% Coverage

- PALS makes students excited and provides a fun atmosphere in the classroom

Reference 3 - 1.20% Coverage

- I liked it so much that every two students sit together and work in harmony with each, which has created a lovely atmosphere of familiarity and closeness in the classroom … It also helped to develop their social skills when dealing with each other.

Reference 4 - 1.03% Coverage

- The atmosphere in the classroom does not only reflect on the students, but also on the teacher, especially in the presence of certain factors such as fun, gameplay, entertainment and keenness on learning a skill

Sub theme: class and behaviour management tool

<Internals\\Transcript 1, Noura> - § 2 references coded [3.73% Coverage]

Reference 1 - 3.45% Coverage

- I am really keen on this program and I like the whole idea … My sister is now a Year 2 primary school teacher in the public education … She has a class-management problem being unable to control her misbehaving students … She once complained that the time allocated for the lesson would be wasted trying to get them organised and as soon as she was about to start, there is hardly any time left for teaching … I proposed the PALS strategy and provided her with some materials, and she welcomed the idea.

Reference 2 - 0.27% Coverage

- it has helped me organise the classroom,

<Internals\\transcript 2, Amal> - § 1 reference coded [1.00% Coverage]

Reference 1 - 1.00% Coverage

- it proved beneficial in terms of time management, which is very useful for the students and makes the maths lesson very enjoyable.

<Internals\\Transcript 5, Nada> - § 1 reference coded [2.41% Coverage]

Reference 1 - 2.41% Coverage

- I felt that PALS helped me so much and really cut the whole process short for me ... For example, Hadeel used to move a lot and lean on the table and she would do the same with the chair ... Rayouf also used to be very chatty with Afnan, while Aisha would sometimes use mockery with her colleagues ... Rana would sometimes put her hands in her pocket and refrain from participating in class … But the PALS program helped me indirectly in dealing with and eventually reducing all those behaviours.

Sub theme: fun and enjoyable

<Internals\\Transcript 1, Noura> - § 3 references coded [3.14% Coverage]

Reference 1 - 2.04% Coverage

- For the students, everything was clear according to specific steps … The same applies to the program which was flowing, easy, light and fun … I think these are the stronger points … The steps of the program are not that complex as the students have only to follow the rules and use the PALS sheets.

Reference 2 - 0.67% Coverage

- I like the fun created by PALS in the classroom in terms of the interaction between the students

Reference 3 - 0.43% Coverage

- I had so much fun with my students during the application stage

<Internals\\transcript 2, Amal> - § 2 references coded [0.59% Coverage]

Reference 1 - 0.30% Coverage

- I find the program generally enjoyable

Reference 2 - 0.29% Coverage

- makes the maths lesson very enjoyable.

<Internals\\Transcript 3, Abeer> - § 3 references coded [1.47% Coverage]

Reference 1 - 0.39% Coverage

- It is fun for children because they like gameplay

Reference 2 - 0.46% Coverage

- it was difficult at the beginning … But it soon became fun

Reference 3 - 0.61% Coverage

- We were having some fun and gameplay so that they could be well-trained on it

<Internals\\Transcript 4, Afnan> - § 1 reference coded [0.77% Coverage]

Reference 1 - 0.77% Coverage

- For my students, the enjoyed the smiley faces and activity sheets which include images, and they also liked so much acting as tutor.

<Internals\\Transcript 5, Nada> - § 4 references coded [3.87% Coverage]

Reference 1 - 1.29% Coverage

- PALS is a novel idea and it really brought the students into life and spurred their enthusiasm and motivation whenever I mentioned to them that we would be learning with PALS … They would get so excited whenever I decided to engage them into some gameplay with PALS

Reference 2 - 0.36% Coverage

- PALS makes students excited and provides a fun atmosphere in the classroom

Reference 3 - 1.19% Coverage

- They also enjoyed the roleplay, especially the role of the teacher too and reinforcing each other … For example, whenever they thought a student deserved to be given the title of 'student of the day', they would give her a smiley face, and so on.

Reference 4 - 1.03% Coverage

- The atmosphere in the classroom does not only reflect on the students, but also on the teacher, especially in the presence of certain factors such as fun, gameplay, entertainment and keenness on learning a skill

Sub theme: help to engage on task

<Internals\\Transcript 1, Noura> - § 1 reference coded [0.43% Coverage]

Reference 1 - 0.43% Coverage

- work together on a specific activity without being distracted.

<Internals\\Transcript 5, Nada> - § 4 references coded [5.28% Coverage]

Reference 1 - 0.93% Coverage

- it engages and motivates students to collaborate with each other and accept each other … Being accepting of each other means a tutee accepts her fellow student to be the tutor and vice versa