

RESEARCH ARTICLE

Development and validation of a tool to measure belongingness as a proxy for participation in undergraduate clinical learning.

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Abstract:

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Background: 'Participation' in a 'community of practice' is often proposed as a mechanism for clinical learning, however the use of both terms is variable – ranging from technical to vernacular.

Belongingness is a related single concept and development of a tool that measures belongingness may therefore be useful in adding to our understanding of when participation and hence learning takes place in clinical settings.

Methods: After identifying relevant material from the literature a draft belongingness assessment tool was developed, based on previously published work. This was piloted on 181 undergraduate medical students and the results subjected to factor analysis. The final version was then used to identify whether differences exist between two different clinical teaching environments.

Results: Our belongingness assessment tool had internal and external validity, with Cronbach's alpha =0.940, and detected statistically significant differences between primary and secondary care teaching environments.

Conclusions: The belongingness scale described in this paper is a valid tool for the study of undergraduate medical students. This has potential to investigate how variation in student experiences of participation in communities of practice influences learning. This tool revealed significant differences in student belongingness between primary and secondary care learning environments.

Introduction

The phrase 'Participation in a community of practice' is widely employed to explain how medical students learn [1]: *'A community of practice is a set of relations amongst persons, activity and world' and 'is an intrinsic condition for the existence of knowledge.'*

Participation in a community of practice is postulated as the mechanism that produces knowledge and in clinical settings participation becomes a key component of learning. But what do we mean by participation?

Lave and Wenger suggest learners start with 'peripheral participation' and progress towards 'full membership' of a community of practice through increasing levels of responsibility and participation [1]: *'to begin with, newcomer's legitimate peripherality provides them with more than an 'observational' lookout post: it crucially involves participation as a way of learning – of both absorbing and being absorbed in – the culture of practice.'* According to the originators therefore, participation is more than observation, involving interacting and being absorbed by the learning environment. It progresses, i.e. is variable. Lave and Wenger were careful to state that their model of participation in communities of practice does not apply to all learning environments; e.g. trainee meatpackers in the USA are part of a community of practice.

Nevertheless, 'participation in a community of practice in clinical learning' is often used as an explanatory mechanism. Although an internet search for this phrase yields over 500,000 results, we were only able to identify a few works where participation appeared to occur partially or not at all [2] and two works where non-participation was implied [3,4], both published before the term 'participation in a community of practice' had been defined. The concept of variable (or absent) participation in clinical learning settings therefore appeared under-investigated, in contrast to our interpretation of Lave and Wenger's original work.

To further explore this concept, we sought to measure 'participation' during clinical placements. However, due to variable technical and vernacular usage, the meaning of 'participation', 'community of practice' and 'participation in a community of practice' have arguably become obscured. The alternative social construct of 'belongingness' has been suggested as an important component of participation which is easier to define and measure. The ability to quantify this component has the potential to help answer questions such as: "Does participation always take place?"; "Is it always of the same intensity?"; "Are there circumstances where participation (and therefore learning) does not take place?"

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What is belongingness?

Dornan et al [5] described the components of experience-based learning, with the triad of doctor, patient and student interacting to facilitate the development of the capability and identity required as doctors. For this process to function effectively, students need to feel a sense of legitimacy within this triad. Lathlean and Levett-Jones [6] identified variation in perceived acceptance and respect in student nurses and suggested that this may explain differences in educational attainment for different students in different environments. They describe the concept of 'belongingness' in clinical placement contexts as the extent to which individuals feel:

- Secure, accepted, included, valued and respected by a defined group.
- Connected with or integral to the group.
- That their professional and/or personal values are in harmony with those of the group.

Although only one aspect of clinical learning, student belongingness defined in this way may represent a quantifiable component of participation in a community of practice. To better

understand factors influencing belongingness, we aimed to develop a tool to quantify belongingness as experienced by students on clinical placements.

What tools are currently available to measure participation in a community of practice?

Levett-Jones et al [7] developed and validated the Belongingness Scale–Clinical Placement Experience (BES-CPE) scale for use in nursing students, later adapted and validated in medical students by Quereshi et al [8]. This addressed aspects of student relationships with their peers, but did not assess quality of teaching or relationships with clinical teachers. The Manchester Clinical Placement Index (MCPI) (Dornan et al [9]) is based on the assumption that students participate in communities of practice which make good learning environments. The domains focus on teaching and environment, but not social aspects of student relationships. There are currently no validated tools specifically designed to assess the broader concept of belongingness amongst medical students. A need remains for a simple, concise tool that assesses all facets of belongingness on individual placements.

Methods

Development of a Belongingness assessment tool

A literature search on Google Scholar, Trip Database and PubMed identified relevant research and existing tools that analyse belongingness or related components of undergraduate learning. This identified three tools with the potential to assess belongingness in medical students: adapted BES-CPE [8], MCPI [9] and the Dundee Ready Education Environment Measure (DREEM) [10]. Following discussion with and permission from the authors, 13 of 34 items in the adapted Belongingness Scale-Clinical Placement Experience (BES-CPE) with loading < 0.5 (suggesting a weak correlation between the observed variables

and the underlying common factor) in the factor analysis described by Quereshi [8] were removed, with 21 remaining items forming the outline of a new questionnaire.

Additional items related to belongingness identified in the MCPI and DREEM were added making a total of 29 questionnaire items, covering relationships with peers, teaching environment and organisation and relationships with senior staff. These questions were modified to a consistent format with a 5-point Likert-type response scale ranging from 1 (never true) to 5 (always true), with negative items reverse-scored, similar to the BES-CPE scale.

A panel of six 5th year medical students assessed face and content-validity after a briefing on “Belongingness” and “Communities of Practice”. The draft questionnaire was reviewed, alongside items excluded from the modified BES-CPE, to determine relevance to the study of belongingness. Additional items suggested by the students were included. Three themes emerged from this discussion: belongingness as a function of relationships with peer group, university and medical profession; belongingness as a function of relationships with clinical teachers and healthcare teams during secondary care placements; and belongingness as a function of these relationships during primary care placements. The items included in the final draft, are shown in Appendix 1.

To ensure adequate sampling, demographic items such as year of study, gender and ethnicity were included. To assess the correlation between belongingness measured by the questionnaire and overall learning experience, an additional item was included, measuring overall satisfaction with the undergraduate medical course. The draft 42-item questionnaire comprised 13 items for secondary care experience, the same 13 items for primary care

experience and 16 items for peer and institutional relationships. This was circulated to the student panel for comment and tested on six different students to determine ease of completion

Data

University of Exeter Medical students in years 1-5 were invited to participate in this study. Study information was presented and paper questionnaires distributed at whole-cohort lectures, with no rewards or negative consequences for participation. Of 181 responses received (39% response rate), 36 were incomplete, leaving 145 responses for analysis, representing 31% of the undergraduate student group.

Analysis

The main purpose of this study was to determine the validity of this tool by investigating internal consistency, construct, convergent and discriminant validity of the subscales. To assess whether the measurement of belongingness is reflected in our empirical data, Exploratory Factor Analysis (EFA) was conducted on the complete 42-item questionnaire. Internal consistency was measured using Cronbach's alpha for the 42-item questionnaire and for each of the three themes identified above (peer/university relationship, secondary care and primary care). Criterion validity of the 42-item questionnaire was assessed by measuring how well the total score correlated with overall course satisfaction, using Spearman's correlation given the categorical nature of our data. Finally, we investigated discriminant validity of the clinical placement subscale by comparing scores for the primary care section with the scores for the secondary care section. Given that students anecdotally describe better teaching experiences in primary care than secondary care, we expected higher scores for the primary care subsection.

Exploratory Factor Analysis (EFA)

EFA estimation is typically based on analysis of Pearson Product-Moment (PPM) correlation matrices, which can lead to bias when the assumptions underlying PPM are violated [11].

Instead we employed polychoric (for ordinal scales) correlations using the *psych* package in

R.

The Kaiser-Meyer-Okin statistic was computed using the correlation matrix of all 42 items to test the appropriateness of the factor model. The literature on factor analysis contains a wide variety of recommendations regarding adequate sample size. These are mainly concerned with the ratio of sample size to number of variables and with the communality of the variables. The adequacy of our sample size was assessed with these two criteria. [13]

We applied EFA to all 42 items using the weighted least square (WLS) method of extraction, given that other more frequently used methods like maximum likelihood (ML) may not provide accurate estimates when the sample size is small [14].

In order to determine the number of factors to retain we used the Kaiser criterion, retaining factors with eigenvalues greater than 1 [16] and Cattell's scree test, which involves an examination of a plot of eigenvalues, (the scree plot), for breaks or discontinuities [15].

Since oblique rotations lead to freely estimated inter-factor correlations and the dimensions that underlie constructs in the social and behavioural sciences tend to be correlated, we used *Promax* rotation as implemented by the *psych* package in R [11]. A cut-off of 0.40 for the factor loadings (as suggested by Howard [13]) was used and lower loading items were removed. All analyses were conducted in R 3.6.1 [11]

Results

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After removing incomplete responses, 145 respondents remained (response rate 31%). The characteristics of respondents, where given, are summarized in table 1. Years one and two had limited exposure to clinical placements and thus had a higher proportion of incomplete responses while the highest participation rate was in year 5.

(table 1 here)

Our 42-item survey had satisfactory overall internal consistency (Cronbach's alpha= 0.94). This did not change significantly when items which correlated very poorly with the rest of the items (Q5, Q15, Q16 and Q17) were removed, one by one and all together.

Appropriateness of the data for EFA was confirmed by the Kaiser-Meyer-Olkin test (0.87). The unrestricted EFA model with 42-items produced four eigenvalues greater than one. The corresponding scree plot shows a sharp bend on the third eigenvalue after which a smooth curve can be seen (appendix 1). As consequence, the results are consistent with four and three factor EFA models.

EFA model restricted to four factors

In this model, the three sections of the survey load separately and nearly completely on each of the first three factors. The first factor loads all the questions of the third section (primary care placements), the second factor loads all the questions of the first section (relationship with peers, the university and profession), except for Q6 (“I feel a sense of belongingness to the medical profession, even though I am still a student”), and the third factor loads all the questions of the second section (secondary care placements), except for Q23 (“I felt that I had a role in the wider clinical team (non-medical members e.g. nurses, admin staff”) and Q24 (“I felt respected as a medical student by the wider clinical team (non-medical members e.g. nurses, admin staff”), which do not load on any factor. The fourth factor loads only Q6 (loading 0.46).

The communalities of most items (representing the amount of variance in the variables that is accounted for by the factor solution as described by Bandalos [16]) are low to moderate (0.4 to 0.7). The exceptions are the low communalities for questions 5 and 14-16. The loadings and communalities for each question for this model are shown in appendix 2.

EFA model restricted to three factors

The scree plot (appendix 1) and the finding that only one question had loading greater than 0.4 on the fourth factor in the 4-factor EFA model suggest a possible three factor structure for our data. In this model, the three sections of the survey load separately and nearly completely on each of the three factors. The first factor loads all the questions of the third section (primary care placements), the second factor loads all the questions of the first section (peer, profession and university relationships), except for Q6 (“I feel a sense of belongingness to the

medical profession, even though I am still a student “) and Q16 (“I am uncomfortable attending social functions involving fellow students on placements because I feel like I don’t belong”), and the third factor loads all the questions of the second section (secondary care placements). The communalities of most items are again low to moderate (0.4 to 0.7) but there are now seven questions with low communalities (0.2-0.39) and one with high communality (0.72). The loadings and communalities for each question for this model are shown in appendix 3.

Convergent validity

Convergent validity was established by the moderate positive correlation between overall satisfaction with the undergraduate medical course and total belongingness score ($\rho = 0.443, p < 0.001$).

Discriminant validity of subscales and comparison of learning environments

The questionnaire responses for the last placement subsection were compared for different clinical environments. Comparing the data for each environment, 8 (5.48%) students gave maximum scores for their last primary care attachment, compared with 1 (0.68%) for secondary care placements. Statistically significant differences were identified between the two types of environment ($p < 0.001$, Wilcoxon signed rank test), as shown in Table 2.

(table 2 here)

Comparing individual student scores for different clinical environments, belongingness experienced in the last primary care placement exceeded the score for the last secondary care placement in 85% of respondents, as shown in figure 1.

(figure 1 here)

Discussion

Summary of results

Validity of this tool for the measurement of Belongingness

The data suggest that the tool has statistical validity for the study of Belongingness in undergraduate medical students, with acceptable participation rate (39%) and proportion of fully completed questionnaires (80%).

Belongingness as a variable

The variation in scores for belongingness support the findings of Lathlean and Levett-Jones [6] that belongingness varies between individuals and teaching environments. Statistically significant differences were seen between different teaching environments, suggesting belongingness and hence participation is variable, and that this tool is sensitive to these differences. This is consistent with the findings of Vivekananda-Schmidt and Sandars in a review of belongingness in education [17], which also identified evidence linking belongingness to identity formation, especially in minority student groups.

Implications

If belongingness is variable, then participation may also be variable, as predicted by Lave and Wenger. Lave and Wenger suggest learning is generated through participation in a community of practice. Therefore, when participation levels are low or absent, learning may also be unacceptably low or absent, with significant implications for design of clinical learning. This tool may therefore be a useful marker for effectiveness of clinical learning attachments - identifying environments with unacceptably low levels of participation (and hence learning) or highlighting high levels of participation. Appropriate action could then be employed to improve participation and hence learning where necessary. If belongingness scores are related to individual student satisfaction and by extension to performance, this may represent a useful academic performance marker, identifying struggling students early on. Longitudinal studies of belongingness and academic performance would be useful to explore this further.

Differences between learning environments

Belongingness scores were higher for primary care than secondary care attachments in 85% of students. Primary care placements usually entail 1:1 or 1:2 learning with senior clinicians and high case turnover. By contrast secondary care placements usually involve more students, less senior contact and more self-directed or practical learning alongside junior doctors. This may partly explain these differences. O'Sullivan et al, [18] also reported higher levels of active teaching and learning during community placements, with higher levels of supervision and feedback, supporting this argument.

The findings suggest that primary and secondary care placements differ significantly in terms of belongingness. If belongingness is a surrogate marker for satisfaction and student perception of learning quality, then further work comparing learning experiences in

community and hospital settings may help define why this difference has arisen. This may help identify which components of undergraduate learning can best be fulfilled in different environments, and help explain why students frequently appear not to feel a sense of belongingness on hospital attachments [2,3,4]

Strengths and weakness of this study, and future research opportunities

Quantification of social phenomena

This research is based on the hypothesis that belongingness represents a quantifiable component of participation in a community of practice and (by extension of Lave and Wenger's theory) clinical learning. Quantification of social processes such as participation can clearly not be relied upon to provide rich explanations and mechanisms of learning and caution must be applied to its deployment. However, this may help determine if participation (and by extension learning) is taking place and to compare this with other clinical environments. As such, it may be a useful starting point where issues of choice and quality of clinical learning experiences are being considered. Conversely, over-reliance on complex social constructs with unclear definitions, to delineate the extent to which they are (or are not) occurring, should be treated with caution. Although Lathlean and Levett-Jones's definition was given at the start of the questionnaire, belongingness has a wide range of meanings in common use, which may have affected student responses. Further qualitative exploration of student understanding of the concept of belongingness as it applies to them, would be useful to determine the role of belongingness in their overall learning experience and how and why this varies between different students.

Learning as a social vs individual process

Participation derives from the field of social learning, a process involving the interactions of many people. However, this study sought to collect data from individuals and extrapolate findings towards larger social groups. Lathlean and Levett-Jones's [6,7] definition relates belongingness to individual student's feelings regarding their relationship to clinical teaching groups, i.e. a function of one side (student experience) of that relationship. It would be interesting to measure reciprocal belongingness in clinical teachers, to determine whether belongingness is a true marker of the strength of teaching relationships, rather than a marker of student satisfaction.

Confounding factors

This study was carried out by the authors on students currently studying at the medical school where two of the authors have significant teaching roles, through invitation at whole year lectures. The response rate was slightly less than 1/3 of the cohort. Although responses were anonymous, students may have been swayed due to feelings of allegiance to the medical school, although this would not explain the difference between different learning environments within the same medical school. Larger studies across more than one institution would allow further study of this issue.

Low student belongingness scores may indicate underlying mental health problems that compromise education, rather than relating to teaching environments. Qualitative and quantitative studies of the individual characteristics and learning experiences of students with a range of belongingness scores would provide insights into this relationship, and whether belongingness is a pre-requisite for, rather than a consequence of effective clinical education. Further exploration of sub-scores relating to peer relationships may also shed light on the

extent to which a medical school's culture and curriculum promotes group cohesiveness and collaboration, rather than competitiveness, and the impact of this on clinical learning.

Comparison of specialties with different teaching ratios or a higher proportion of direct consultant teaching e.g. psychiatry, would help explore the reasons for varying belongingness scores between and within primary and secondary care placements, and how much of this relates to teaching ratios. Comparison of different medical schools would help identify whether individual schools have cultures that influence belongingness in clinical (and non-clinical) environments and larger samples would allow comparison of different demographic groups. Longitudinal studies would help explore how belongingness develops as individuals progress through their education.

Conclusion

Belongingness is to a certain extent a quantifiable factor that varies between different students and teaching environments. Our tool designed to measure belongingness has validity and identified statistically significant differences between clinical placements. The findings merit further exploration to identify opportunities to improve equality and efficacy of teaching and learning in clinical learning environments.

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Disclosure of interest

Two of the authors (AH and RD) are involved in clinical teaching of undergraduate medical students in primary care at the University of Exeter.

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Ethical approval

Ethical approval was obtained from the MSc Clinical Education programme team, operating with delegated authority on behalf of the University of Exeter Medical School's Research Ethics Committee.

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Appendix 1: Questionnaire

Relationship with peers, medical profession and university

1. I feel that there are other students at the medical school like me
2. I feel that there are other students at the university like me
3. I feel that there are people like me in the medical profession, even though I am still a student
4. I feel a sense of belongingness to the medical school
5. I feel a sense of belongingness to the university
6. I feel a sense of belongingness to the medical profession, even though I am still a student
7. I feel understood by my fellow students (either in professional or personal sense)
8. I feel that my fellow students are interested in my life outside my studies
9. I feel that I could approach my fellow students outside placements
10. I respect the other students I work with on placements
11. I think that the students I work with on placements respect me
12. Other students on my placements invite me to eat lunch/dinner with them
13. When I walk up to a group of fellow students on a clinical placement, I feel welcomed
14. Colleagues notice when I am absent from a placement
15. I feel confident in my knowledge and ability compared to my fellow students
16. I am uncomfortable attending social functions involving fellow students on placements because I feel like I don't belong*

Experience of clinical placements

17. I felt that the senior clinical staff treated me as an equal
18. I would have felt comfortable asking for support or advice from senior clinical staff when I needed it
19. I felt able to actively participate in clinical teaching e.g. by asking questions

20. I felt the senior clinical staff treated me as an individual
21. I felt the senior clinical staff knew who I was
22. When I walked up to the staff on the first day of this placement, I felt welcomed
23. I felt that I had a role in the wider clinical team (non-medical members e.g. nurses, admin staff)
24. I felt respected as a medical student by the wider clinical team (non-medical members e.g. nurses, admin staff)
25. The clinical staff (doctors) on the placement made me feel like I was wasting their time*
26. I felt that the clinical staff (doctors) were happy to make time to teach me practical procedures
27. I was uncomfortable attending meetings e.g. ward rounds on the placement because I felt that I didn't belong*
28. I felt discriminated against on placement (you can provide more details of this at the end)*
29. I felt a sense of belongingness to the team on this clinical placement