

# Peer assisted learning: teaching dental skills and enhancing graduate attributes

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## IN BRIEF

- Discusses peer assisted learning (PAL), which involves students in the teaching of one or more fellow students, and is largely underused within dental education.
- Shows that, provided it is carefully planned and implemented, it is beneficial in the teaching of simple dental clinical skills.
- Suggests that PAL also seems to have a place in facilitating student engagement with graduate attributes.

This study describes a pilot project in which peer assisted learning (PAL) is used to teach dental clinical skills. A cluster randomised controlled trial compared opinions of Bachelor of Dental Surgery (BDS) students from peer-led groups versus staff-led groups in a clinical (impression taking) and a pre-clinical (handpiece skills) task. BDS5 (peer tutors) in their final year delivered teaching to BDS1 (tutees) for each task. Quantitative data from tutees and the peer tutors was gathered from questionnaires, along with open written comments. PAL was well received by both tutees and peer tutors. BDS1 tutees rated BDS5 peer tutors highly for delivery of information, and level of feedback. The tutees considered peer tutors more approachable and less intimidating than staff. Peer tutors reported their own knowledge had increased as a result of teaching. In a summative OSCE (objective structured clinical examination) four months following the teaching, no statistical significant difference between the performance of peer-led and staff-led groups was found at stations related to the subject matter in question. It is argued that PAL, as well as being a useful method of delivering subject-specific teaching, is able to contribute to the development of graduate attributes.

## INTRODUCTION

Peer assisted learning can be defined as 'an educational experience in which one student teaches one or more fellow students'.<sup>1</sup> A slightly wider and well used definition, which emphasises the benefits to the learner, is 'development of knowledge and skill through explicit active helping and supporting among status equals or matched companions, with the deliberate intent to help others with their learning goals'.<sup>2</sup>

A key consideration in the concept of peer teaching is the distance in educational level between student learners and teachers. If students are separated by a number of years, this is often referred to as near peer learning.<sup>3</sup> Other features of interest include the size of groups, and style of taught topic, be it skills or knowledge-based.

Peer assisted learning (PAL) has been used extensively in other professional courses such as medicine, nursing and veterinary medicine. Various studies have used peer learning for developing clinical

skills in medicine such as musculoskeletal examination<sup>4</sup> or surgical skills.<sup>5</sup> There is one systematic review of its use with medical students, which indicates that participating student teachers benefit academically and professionally.<sup>6</sup> Examples of benefits include increased confidence for the peer teachers and the approachability of peers for the junior students. The review concludes that the longer term effects are poorly understood, and more research is needed. There are examples of PAL and its use with nursing and veterinary students, in developing clinical skills.<sup>7,8</sup> There would appear to be few published reports of peer learning in dental education, particularly from the clinical perspective, with the studies available focusing on the teaching of anatomy or health care simulation.<sup>9-11</sup> The use of peer learning in dentistry merits further investigation, especially from a clinical perspective, given the potential educational benefits for both groups of students.

Two separate but aligned areas of current importance in dental education are the emergence of graduate attributes as a concept, and in the UK, the need to map curricula to the General Dental Council's (GDC) outcomes for the dental team – '*Preparing for practice*'.

Students of all disciplines, including that of dentistry, are graduating into a challenging economic climate. Universities are aware of the need to ensure that their graduates

are fit for purpose, and many universities have responded to this challenge by developing a concept framework known as 'graduate attributes'.<sup>12,13</sup> These transferable skills should be applicable to the external world including that of employment.<sup>14</sup> Many universities who train dentists have explicit evidence on their websites of attempts to develop graduate attributes.

The GDC quality assures the training of dental students in the UK, via a programme of visitations and release of guidance documents. The most recent curriculum guidance for dental education providers, '*Preparing for practice*', is an outcomes-centred document that sets out the outcomes required of all dental professionals on registration.<sup>15</sup> There is much greater emphasis on communication, professionalism, and management and leadership, than was the case in previous documents. Learning and teaching, assessment, feedback, reflection, training, appraisal and team work all feature in *Preparing for practice* and outcomes in these domains would seem to align well with the vision of graduate attributes. It also seems likely that the experience of PAL, for teacher and learner, could lead to greater engagement with these outcomes.

## AIMS

To undertake a pilot study in peer assisted learning (PAL), using one clinical and one pre-clinical topic

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To evaluate the perceptions and experiences of students, in the roles of both teacher and learner, who participated in PAL

To ascertain the educational benefit for students who participated in PAL.

## METHODS

### Trial design

A cluster randomised controlled trial design was adopted. The participating students were BDS1 who would either be peer taught by BDS5, or by clinical teaching staff. Two tasks, one clinical and one pre-clinical, were selected for the trial. Task one, the clinical task of impression taking took place within the clinical restorative area in Glasgow Dental School (GDS). With regards to task two, the preclinical task of 'handpiece skills' took place within the pre-clinical skills area in GDS.

Ethical approval was sought and obtained from the University of Glasgow, School of Medicine Ethics Committee (FM03908).

Randomisation was by student grouping. BDS1 students are normally divided into eight groups of approximately 11/12 students and undergo clinical teaching in these groups. Four of these groups were randomised by the statistician to teaching by peer (peer group), and four by clinical teacher (staff group). The ratio for student to teacher in all the peer tutor groups was between 2:1 and 4:1. For control groups, led by clinical teaching staff, the ratio of student to teacher varied between 8:1 and 10:1.

### Recruitment

Both year groups of students were recruited and briefed separately. BDS5 peer tutors were recruited by letter, which outlined the reasons for the study and invited voluntary participation. In all, 20 BDS5 students participated. Eleven tutors undertook Task one, with 15 tutors taking part in Task two. Six tutors took part in both tasks.

BDS1 students were given information about the study, and asked to sign consent forms if they wished to participate. It was made explicit that they need not take part, and if they did not wish to, they would be taught by clinical staff. No BDS1 student refused to take part. Of the students, 87 BDS1 took part in task one (five were absent due to illness), with all 92 students taking part in task two.

### Tasks

Two tasks, usually taught as part of the 'Introduction to Dentistry' course in Year 1, were selected as being suitable for delivery by PAL. These tasks were 'impression taking' and 'handpiece skills'. Task one for the peer

tutors consisted of demonstrating the taking of alginate impressions of a dentate mouth, in stock trays, and then supervising the more junior students taking upper and lower alginate impressions of each other.

Task two required BDS1 students to cut a practice cavity on a multi-layered training plate consisting of 2D outlines of teeth (Nissin Dental Inc). The different layers of the plate gave the junior students the idea of depth perception. The peer trainers were required to give a demonstration to the more junior students using the training plates. They then had to supervise the students as they used a handpiece for the first time, and undertook the demonstrated clinical task.

### Training of peer tutors and staff briefing

Peer tutors received training in generic teaching skills, in addition to information about the specific tasks they were allocated to teach. For task one, peer tutors received specific instructions in a hands-on impression taking training session from an experienced tutor. For task two, peer tutors were taught about the training plates and had the opportunity for a practice session with the staff member who wrote the lesson plan. Staff received copies of all materials distributed to the students, and were briefed about the sessions.

### Measures of outcomes

#### Questionnaire design

Questionnaires were designed by the research team and utilised both open and closed sections to collect data from participating BDS5 and BDS1 students. Separate questionnaires were completed after each task. In the closed section students were required to respond to a number of questions (see Tables 1–4) using a five-point Likert scale. The questions used in the open sections were as follows:

- What was done well? (both sets of students)
- What could be improved? (both sets of students)
- What was it like being taught by a student? (tutees)
- What was it like teaching students? (peer tutors)

#### Summative assessment outcomes – OSCE

The assessment schedule for BDS1 included a summative end of year examination in the form of an OSCE, four months after the teaching. Two of the OSCE stations examined topics covered by the study, namely handpiece skills and impression taking. With regards to the impression taking station,

students had to identify faults in an impression, along with questions relating to the process of taking an impression. With respect to the handpiece skills station, students had to identify the different handpieces, select the appropriate burs with which to load a high speed handpiece and demonstrate the correct positioning of it. Each of the allotted tasks was out of 10 marks. Performance in these stations was evaluated, to see if there was a difference between those BDS1 students who had been taught by peers and those taught by staff.

### Approach to analysis

#### Statistical analyses

All data were analysed in Stata (version 10; StataCorp). Comparing responses to the questionnaires between the two groups was carried out using Chi-squared tests or Fisher's Exact Tests (when expected cell size <5). Student's t tests were used to compare performance in OSCE stations between the two groups, and mean differences and 95% confidence intervals for the differences were reported.

#### Analysis of qualitative data (open comments)

Simple content analysis was undertaken, with the comments being read and reread, and then aggregated into themes. The data was not in sufficient depth to undertake the full process of primary, secondary and tertiary analysis, using a specific qualitative analytical methodology.

## RESULTS

### Responses from the questionnaires based on Likert Scales

#### Perceptions and experiences of tutees: comparison of peer vs staff groups

Tables 1 and 2 below present the data from the closed questions. Unanimously, students found both tasks interesting. For impression taking there was very little difference between PAL and control groups in relation to most of the questions as shown in Table 1.

In relation to the question, 'I did not feel comfortable asking questions', a higher proportion of students in the peer group strongly disagreed with this statement (61% vs 26%). Higher numbers of peer taught students said their tutor provided useful feedback (71% vs 57%).

With regards to the handpiece skills, there were a number of differences between the groups as shown in Table 2. Students in the peer group rated peer tutors' teaching more

**Table 1 Task one – Taking alginate impressions. Feedback from BDS1 students (tutees)**

Peer taught group n = 41 Absent/no data (n = 5) Staff taught group n = 46	Peer Strongly agree	Peer Agree	Peer Neutral	Peer Disagree	Peer Strongly disagree	Staff Strongly agree	Staff Agree	Staff Neutral	Staff Disagree	Staff Strongly disagree	P value
I found the clinically based sessions interesting	93% (38)	7% (3)	0	0	0	87% (40)	13% (6)	0	0	0	0.525
The tutor seemed well informed	83% (34)	17% (7)	0	0	0	91% (42)	-9 (4)	0	0	0	0.389
The tutor was clear when explaining the sessions	81% (33)	17% (7)	2% (1)	0	0	87% (40)	11% (5)	2% (1)	0	0	0.577
The tutor provided useful feedback	71% (29)	27% (11)	2% (1)	0	0	57% (26)	39% (18)	4% (2)	0	0	0.4
I was confident in undertaking the session following my tutor explanation	37% (15)	61% (25)	2% (1)	0	0	50% (23)	41% (19)	9% (4)	0	0	0.08
I did not feel comfortable asking questions	2% (1)	5% (2)	3% (1)	29% (12)	61% (25)	2% (1)	0	13% (6)	59% (27)	26% (26)	*<0.001
I would not recommend this approach to others	5% (2)	2% (1)	0	13% (5)	80% (33)	2% (1)	2% (1)	0	18% (8)	78% (36)	0.832

Note: The numbers in parenthesis are the actual number of respondents.

**Table 2 Task two – handpiece skills: Feedback from BDS1 students (tutees)**

Peer taught group n = 41 Absent/no data (n = 5) Staff taught group n = 46	Peer Strongly agree	Peer Agree	Peer Neutral	Peer Disagree	Peer Strongly disagree	Staff Strongly agree	Staff Agree	Staff Neutral	Staff Disagree	Staff Strongly disagree	P value
I found the clinically based sessions interesting	91% (42)	9% (4)	0	0	1	91% (42)	9% (4)	0	0	0	1
The tutor seemed well informed	91% (42)	9% (4)	0	0	0	96% (44)	4% (2)	0	0	0	0.678
The tutor was clear when explaining the sessions	96% (44)	4% (2)	0	0	0	83% (38)	15% (7)	2% (1)	0	0	0.092
The tutor provided useful feedback	87% (40)	13% (6)	0	0	0	61% (28)	35% (16)	2% (1)	2% (1)	0	0.005*
I was confident in undertaking the session following my tutor explanation	70% (32)	30% (14)	0	0	0	41% (19)	52% (24)	7% (3)	0	0	0.003*
I did not feel comfortable asking questions	4% (2)	0	0	16% (7)	80% (37)	2% (1)	11% (5)	2% (1)	39% (18)	46% (21)	<0.001*
I would not recommend this approach to others	0	2% (1)	0	2% (1)	96% (44)	7% (3)	0	0	18% (8)	75% (35)	<0.001*

Note: The numbers in parenthesis are the actual number of respondents.

highly in a number of areas, by strongly agreeing regarding provision of useful feedback (87% *vs* 61%) and confidence in undertaking the task following teaching (70% *vs* 41%). More peer taught students strongly disagreed with the statement 'I did not feel comfortable asking questions' (80% *vs* 46%).

### Perceptions and experiences of peer tutors

Tables 3 and 4 present the data from the closed questions. For impression taking, the peer tutors found the junior students were attentive and inquisitive, and tutors felt confident in undertaking the session, and comfortable answering questions. The peer tutors were split with regards to whether the clinically based sessions were challenging.

For handpiece skills, the peer tutors found the junior students similarly inquisitive and attentive, and tutors felt that they gave good feedback. However, in contrast to the impression taking, the tutors did not feel confident in delivering this session.

All peer tutors would recommend PAL for both impression taking and clinical skills.

### Summative performance

The results for the two OSCE stations, hand-piece skills and impression taking, were compared to see if there was any benefit or disbenefit in being taught by a peer. As can be seen from Table 5, the mean scores were similar though slightly higher in both the peer taught groups (7.91 *vs* 7.48,  $p = 0.173$ ) for handpiece skills and (7.46 *vs* 6.83,  $p = 0.151$ ) and impression taking.

### Qualitative feedback

Comments in the open sections of the questionnaire from BDS1 and BDS5 students will be considered separately.

#### Tutee comments

A number of issues emerged from the limited qualitative data. BDS1 students who had been allocated to a staff group, fed back principally about staff numbers, particularly in relation to the amount of time allocated to the teaching of this task. Some students commented on feeling 'rushed'. Lower numbers of staff meant less time per student interaction

*'More staff, it was hard to get attention at times' (Staff taught Y1)*

The approach to teaching also featured in the feedback. Students noted and commented

on the formality of the teaching environment with the staff tutors.

*‘Having a more independent experience would have improved the class as the staff tutor often took over’ (Staff taught Y1)*

However, while staff teaching may have been more formal, students were aware of the ‘expert’ nature of the staff teaching

*‘The session was very informative and the tutor had a vast experience, going into depth about what the session was about. The lesson seemed very structured’ (Staff taught Y1)*

This was in contrast to the informality and approachability of the peer teaching.

*‘It felt a lot more relaxed being taught by a student’ (Peer taught Y1)*

Confidence, and the ease of asking questions was also mentioned. The fact that the senior students had more recently been through the whole process of encountering clinical topics for the first time, made the more junior students feel that their position was better understood.

*‘No fear of ‘silly’ questions and students could relate to their own experience of first impressions and further experience throughout the course’ (Peer taught Y1).*

*‘Felt it was very easy to ask questions. The pupil-tutor knew what she was talking about and explained what she found difficult when she was taking impressions for the first time’ (Peer taught Y1)*

None of the first year students felt disadvantaged if they were allocated to the peer teaching group.

### Peer tutor comments

BDS5 peer tutors commented positively on what they perceived to be the quality of the learning experience for BDS1 tutees. The main perceived advantage was the lower student to tutor ratio, with more time available to provide teaching and support.

*‘The teaching was done well, this was reflected in the ease in which the first years took the impressions.’*

*‘It was good working closely with small groups. It made it easy to give them support and personal feedback.’*

Feedback from the BDS5 peer tutors, showed that they appreciated the element of individual personal development derived from participating in the project. Students reflected that their own learning improved. Enjoyment, team and confidence building were recurrent themes.

*‘I really enjoyed this experience. I think it allowed me to focus on my impression taking technique.’*

*‘It was good. I enjoyed teaching the students and felt that I could help them with things that I learned throughout the course.’*

*‘Very useful to also improve my learning’*

**Table 3 Task One – Taking alginate impressions: Feedback from BDS5 students (peer tutors)**

Peer tutors = 11	Peer Strongly agree	Peer Agree	Peer Neutral	Peer Disagree	Peer Strongly disagree
I found the clinically based sessions challenging	18% (2)	36% (4)	18% (2)	9% (1)	18% (2)
The trainees were attentive	64%(7)	36% (4)	0	0	0
The trainees were inquisitive	27% (3)	55% (6)	9% (1)	9% (1)	0
The feedback I provided was useful during the session	45% (5)	36% (4)	18% (2)	0	0
I did not feel comfortable asking questions	0	0	0	27% (3)	73% (8)
I was confident in undertaking the sessions	73% (8)	27% (3)	0	0	0
I would not recommend this approach to others	0	0	0	36% (4)	64% (7)

Note: The numbers in parenthesis are the actual number of respondents.

**Table 4 Task two – Handpiece skills: Feedback from BDS5 students (peer tutors)**

Peer tutors = 11	Peer Strongly agree	Peer Agree	Peer Neutral	Peer Disagree	Peer Strongly disagree
I found the clinically based sessions challenging	0	53% (8)	7% (1)	33% (5)	7% (1)
The trainees were attentive	67% (10)	33% (5)	0	0	0
The trainees were inquisitive here (n = 14)	33% (5)	60% (9)	0	0	0
The feedback I provided was useful during the session	7% (1)	86% (13)	7% (1)	0	0
I did not feel comfortable asking questions	0	0	0	33% (5)	67% (10)
I was confident in undertaking the sessions	0	0	7% (1)	53% (8)	40% (6)
I would not recommend this approach to others	0	0	0	0	100% (15)

Note: The numbers in parenthesis are the actual number of respondents.

When faced with the task of supervising the use of handpieces and training plates, the peer tutors held similar views:

*‘I really enjoyed this better than the impressions (but I liked that too), this was more hands on. ‘Really enjoyed it. Wouldn’t mind doing it again. Feels great to receive positive feedback from my students’*

The importance of feedback, and reflection for BDS5 were both highlighted.

*‘Very useful as I think I learnt a lot about my skills and how to improve. Giving feedback to others and seeing them improve made me realise that listening to feedback is vital to improve clinically.’*

### DISCUSSION

Not surprisingly, perhaps, students in the first year of their BDS programme were enthusiastic about undertaking pre-clinical

and clinical tasks, whichever group they were allocated to. Early clinical contact is thought to be very important for junior students, as it gives them both a sense of belonging to the dental school environment, and reaffirms their career choice.<sup>16</sup>

A limitation of the study was that the peer tutors recruited into the study were volunteers, and as such may have been different from the non-PAL participants who may have been less positive about the initiative.

Ahead of recruitment it was postulated that the more able students would volunteer, but students from the full range of ability, based on past academic performance, took part.

The use of randomisation meant that any biases in allocating students to groups were minimised. Masking was not possible in this trial, so the favourable result could be due to the novelty of teaching approach.

The higher tutee: tutor ratio in the staffed groups was unfavourably commented upon by students. While PAL should not be considered a means of compensating for inadequate levels of teaching staff, it is nonetheless true that availability of peer tutors may frequently exceed that of clinical teaching staff. This may be seen as an inherent benefit of PAL and it is certainly one the students reinforced. The requirement for training of peer tutors is an important issue. The one systematic review of peer teaching with medical students suggests that consideration needs to be given to the support that the student-teacher receives before, during and after the event.<sup>6</sup> PAL therefore requires the involvement of clinical teaching staff in planning, and in the training and support provided to students who will be involved in teaching. Quality assurance is also essential and should include some form of evaluation to ensure learning outcomes are being met.<sup>17</sup> With PAL, therefore, potentially, the focus of professional educators shifts from the hands-on delivery of teaching to the planning of the episodes, the training of peer tutors and the quality assurance of the whole process. Demands on staff time still exist. However, at Glasgow, particularly in response to positive student feedback, the peer assisted learning programme has been extended to include other year groups and topics, and it continues to receive positive comments from participating year groups.

The small sample size may have impacted on the ability to detect meaningful differences between the groups as statistically significant; however, the study was constrained by the size of the year groups. Future studies should recruit from multiple centres in order to improve statistical power if necessary.

A key feature of the positive response to PAL was the supportive learning atmosphere created; students found the sessions relaxed and enjoyable. There is thought to be cognitive congruence between the two groups, with the peer tutors more recently having interface with the topics being taught, and such insight allows them to use concepts and language that learners easily understand.<sup>3</sup> The students also found the peer trainers approachable, and felt more able to ask questions. Student learners are more at ease with the peer tutors due to social congruence, as they share similar social roles within the dental school.<sup>6</sup> Furthermore, students were equally confident in undertaking the task, whether taught by staff or peer tutors, and summative assessment of the clinical skills concerned revealed similar mean scores in each group. It would seem, therefore, that in well-regulated circumstances, PAL can be a useful method of teaching simple clinical

**Table 5 BDS1 (tutees) Mean scores in the objective structured clinical examination (OSCE). Handpiece skills and impression taking**

Station out of 10 marks	N	Mean	Mean difference	95% confidence interval of the difference		P value
				Lower	Upper	
<b>Hand piece skills:</b>						
Peer taught	46	7.91	0.435	-0.194	1.063	p = 0.173
Staff taught	46	7.48				
<b>Impression taking:</b>						
Peer taught	46	7.46	0.63	-0.234	1.495	p = 0.151
Staff taught	46	6.83				

**Table 6 Peer assisted learning utilising BDS1 and BDS5, and the interface with graduate attributes, University of Glasgow. O = not applicable; X = applicable**

Graduate attribute	Junior students: BDS1	Senior students: BDS5
Subject specialists	X	X
Investigative	O	X
Independent and critical thinkers	X	X
Resourceful and responsible	O	X
Effective communicators	O	X
Confident	X	X
Adaptable	X	X
Experienced collaborators	X	X
Ethically and socially aware	O	X
Reflective learners	X	X

skills in Dentistry. But if considerable effort is potentially required to develop, implement and evaluate PAL schemes, why bother? What additional benefits might PAL offer?

Peer tutors reported extremely positive views on the experience of teaching. The data from questionnaires indicated that peer tutors were taking ownership and responsibility for delivering the lesson. Peer-tutor comments indicated that teaching had deepened their understanding of the tasks through preparation and consideration of how delivery of the lesson should best be achieved, supporting previously cited benefits.<sup>18,19</sup> Some peer tutors reported less confidence in delivery of the handpiece skills than with the impression taking, and this may be due to the fact that it was a new introduction into the BDS1 curriculum, as opposed to the impression taking which had formed part of the course for some years.

Although the specific expression of graduate attributes will vary from one educational institution to another it is not difficult to see how the experience of preparing for and delivering teaching may help to develop these generic skills. The University

of Glasgow Graduate Attributes Matrix<sup>20</sup> (and therefore applicable to the students in this study) suggests that graduates should be resourceful and responsible, effective communicators, confident and adaptable, among other things. Effective teaching certainly requires such attributes. Other attributes, such as the ability to collaborate and to learn through reflection, are equally relevant to both tutees and peer tutors and, again, PAL may help with the development of these skills. Table 6 summarises how the experience of PAL might map onto graduate attributes. However, it is one thing for students to engage in activities that implicitly help them to develop graduate attributes, it is another for them to explicitly realise that it is happening. This may be important, since students' ability to comprehend what they have learned, and the skills that they have acquired (and how), will impact on their ability to articulate this to potential employers and to set targets for future learning. The comment about feedback – *'giving feedback to others and seeing them improve made me realise that listening to feedback is vital to improve clinically'* – was telling, especially

when the very critical reviews of feedback found in the National Student Survey are considered. Impressive though this student's observation undoubtedly is, in retrospect it seems reasonable to suggest that the experiential learning derived from PAL could have been reinforced by a facilitated process of reflection, in which implicit engagement with graduate attributes was brought to the surface for the students involved.<sup>21</sup> Both tutees and tutors could benefit from such an activity: BDS5 students as they prepare for recruitment and employment; and BDS1 students in developing an understanding of the concept of graduate attributes, and evidencing their attainment, at an early stage in the programme.

The concept of graduate attributes appears to sit comfortably within the expanded outcomes in the 'communication', 'professionalism' and 'management & leadership' domains of *Preparing for practice*. PAL would seem to offer an attractive means of facilitating the development of outcomes such as:

- '9.2 Utilise the provision and receipt of effective feedback in the professional development of self and others
- 9.3 Explain the range of methods of learning and teaching available and the importance of assessment, feedback, critical reflection, identification of learning needs and appraisal in personal development planning.'

as well as others. This is the potential 'added value' of PAL, over and above its usefulness in the imparting of knowledge and clinical skills.

## CONCLUSION

Peer assisted learning (PAL) is a well-recognised method of utilising students to teach other students that may be underutilised in dental education. This study suggests that, provided it is carefully planned and implemented, it is beneficial in the teaching of simple dental skills within a pre-clinical and clinical setting. It would also seem to have considerable utility in facilitating student engagement with graduate attributes. Further work utilising a multicentre approach is required to determine the full effectiveness of PAL.

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