Practice and Evidence of Scholarship of Teaching and Learning in Higher Education
Vol. 1, No. 2, October 2006, pp. 73-93

A comparison of teaching methods for teaching dental technology to undergraduate dental students: a pilot study.

Donald Cameron*,
University of Glasgow Dental Hospital & School
d.cameron@dental.gla.ac.uk
Tel: 0141 211 9628
Robert McKerlie,
University of Glasgow Dental Hospital & School
r.mckerlie@dental.gla.ac.uk
Tel: 0141 211 9732
Bob Matthew,
Learning and Teaching Centre,
University of Glasgow
r.matthew@admin.gla.ac.uk
Tel: 0141 330 3197

Abstract

This article reviews a pilot study comparing two teaching strategies in an existing course, where one of the strategies was the usual method of delivery in a professional vocational course. The authors present a case study explaining their hypothesis that a small group intensive teaching method (microteaching) concentrating on cognitive learning can be a viable alternative to the usual experiential method concentrating on developing psychomotor skills. The microteaching method was an attempt to address the issue of a reduction in time for technology in the dental curriculum while delivering a course that would provide a thorough knowledge and understanding. The difference between the teaching methods is used to show how students respond to an element of self-study within their learning stratagem. The authors argue a case for students taking greater responsibility for their learning through self–assessment and reflection.

Key words: teaching, microteaching, self-study, self–assessment, reflective journals, dental

* Corresponding author

ISSN 1750-8428 (online) www.pestlhe.org.uk

Introduction

What is dental technology?

The discipline of dental technology is the creation of replacements for natural teeth and the fabrication of corrective oral devices. In restorative dentistry, dental technology is used in fixed prosthodontics for inlays, crowns and bridges cemented in place and removable prosthodontics, partial and complete dentures. Such prostheses may be made onto existing teeth prepared by a dentist or on titanium fixtures implanted in the upper or lower jaws. In orthodontic dentistry dental technicians fabricate orthodontic appliances for corrective procedures. The dental technician works to a prescription written by a dentist.

A dentist is responsible for the delivery of oral appliances to patients (Dentist's Act 1984). In restorative dentistry the dentist is required to be competent in a range of operational and non-operational management procedures in both diagnosis and planning (General Dental Council, 2002: 31). For the restoration of missing teeth the dentist is required to have knowledge of how to replace teeth and the laboratory procedures used in making these replacements. This knowledge enables the dentist to design and evaluate prostheses and enable him or her to be able to make appropriate chairside adjustments (General Dental Council, 2002: 29). In order to do this there is a Dental Technology Techniques training course for dental students within the undergraduate dental curriculum.

The reduction of hours in dental technology within the dental curriculum has resulted in little time for dental students to develop the necessary psychomotor skills to undertake dental technology procedures, which had been the traditional method of training. Dental students are often unsure and lack confidence regarding dental technology because they cannot attain a professional level of competence within the time available in the curriculum and often fail to fully appreciate the discipline's significance.

Hours devoted to technology in the dental curriculum

From the time of regulations in 1918 that led to the Dentists' Act of 1921, Douglas (2003: 1) identified the subjects undertaken at a recognised dental school as dental anatomy and physiology – human and comparative, dental histology, dental surgery and

pathology, dental materia medica, dental metallurgy, dental bacteriology and dental mechanics (technology).

At that time, the proportion of dental mechanics within the course was considerable. Dental students were required to complete three years of their five-year course learning dental mechanics, approximately 6,000 hours (Todd, 1977). The hours devoted to dental mechanics was still considerable in the General Medical Report of 1933 where the following recommendation was made "that a student should not receive less than 24 calendar months or 2,000 hours practical instruction in dental mechanics" (Murphy, 1978, 139).

In the General Dental Council report of 1963, the recommendation was given that "instruction should be given for not less than 800 hours" (cited in Murphy; 1978, p.139). There was also criticism that there had been excessive, repetitive exercises in dental mechanical technology education in the 1975 report. Currently, the time in the undergraduate curriculum devoted to dental technology techniques is less than 300 hours. This continued reduction of time to technology within the curriculum is reflected also by the relevance of the subject by the Dental Schools in the United Kingdom Quality Assurance Agency for Higher Education Review Reports (QO6, Q58/99, Q44/2000, Q172/2000, Q112/99, Q113/99, Q218/99, Q127/2000, Q69/99, Q25/99, Q252/2000, Q4/99, Q284/2000).

In the Quality Assurance Agency for Higher Education Review Reports on Dentistry in the United Kingdom from 1998-2000 and the Scottish Education Funding Council Quality Assessment Reports (1992-1998) dental technology was only mentioned directly in one report (Queen's University Belfast; 7, 41) and indirectly in two (University of Bristol, Q44/2000; University of Sheffield, 284/2000). These examples are not references as such but rather the relevant parts of the reports.

However, the review of Dentistry 1998-2000 (QO6/2000: 9f) included the statement *"some practical teaching and learning facilities are examples of best practice such as…and the dental technology laboratory*", indicating that dental technology was not being ignored. There are currently degree courses in dental technology for dental technicians in only two British Universities; Manchester Metropolitan University and the University of Wales.

Quantifying the number of hours that might be devoted to dental technology within the curriculum is difficult. Dental undergraduates are recommended to have a 'thorough knowledge' of technology procedures in the General Dental Council's policy document 'The First Five Years' (General Dental Council, 2002). However, recent literature suggests technology training is perhaps less than it should be to enable sufficient understanding. Clarke (2002) stated that graduates were not confident in complete denture prostheses citing the reduction of undergraduate teaching. This reduction of time for technology teaching is an important consideration. Following graduation dentists struggle with removable partial denture design (Lynch and Allen, 2006). Commenting on the Lynch and Allen study, Barsby (2006) stated that little seemed to have changed in thirty years concerning the failure of dentists to provide adequate instruction for removable partial denture design (Basker and Davenport, 1978; Stafford et al, 1982; Basker et al, 1988).

Relevance of technology in the curriculum

The percentage of adult edentulous patients provided under the General Dental Service figures in 1990 was 20 percent of patients in England and Wales (McCord and Grant, 2000: 1-2; Davenport et al, 2000; 3-4). In the most recent Adult Dental Health Survey 1998, there were 12% of adults in England and Northern Ireland, 17% in Wales and 18% in Scotland who were edentate. For partially dentate patients, those patients with 21 teeth (which is the number used as an indicator to a functional dentition) was almost 100% up to age 34 but the proportion reduced to less than half the dentate population at age 55 and over. Thus it is clear that the work of the dentist still involves considerable time in the design and fitting of oral appliances, (Adult Dental Health Survey 1998).

Methodology

This pilot study was conducted during the first term and the first two weeks of the second term of the third year of the Bachelor of Dental Science (BDS) course, (approximately 90 hours).

The traditional teaching method used in the dental technology-teaching laboratory at the University of Glasgow had been to divide the year of approximately 70-80 students among the four members of laboratory staff, to provide groups comprising of between

15 and 20 students. Reported feedback from students using this method highlighted concerns and problems from both staff and students. Some concerns were:

- Students often were unsure of the nature of this part of the course and its relevance to their work as dentists.
- When undertaking a technical task the student often failed to appreciate the standard that was required for a piece of technology. A familiar comment was that they understood the principle of what was involved but failed to realise that standard was of paramount importance, therefore when they had an assessment they often underachieved.
- The inefficient use of time. Group sizes of between 10 and 20 for a course dependent on psychomotor skills and manual dexterity meant that students became teacher-dependent, often having to wait for some time to be given feedback. Indeed, in some circumstances students under severe time pressure are often dependent on technical staff to provide actual physical assistance with aspects of their course work.

Shared Groups

In the year 2002/2003, in an attempt to address these issues an alternative teaching approach was introduced where two groups of students were combined with two members of staff. The hypothesis for this initiative was to provide better understanding for students before they attempted a task. Furthermore, creating an achievable goal or target enabled students to concentrate of the practical element of the laboratory tasks. Working in small groups concentrated the intensity of the session. The explanation of intensity was a more efficient and effective use of time within the small group format. Effectively, two members of staff shared the teaching responsibility for this group. This addressed staff and students' concerns. Two staff members working together were able to perform a number of shared teaching actions including:

- Different work tasks within the group could be done simultaneously. This was always a difficulty when students were dependent on teachers for assessment and feedback.
- Catch up for individual students was facilitated. Students who missed a demonstration found it difficult to catch up. Packer et al, (2001) reported that

dental students preferred a live demonstration for the teaching of removable partial denture procedures to a videotaped programme. The reason for this was principally for the interaction between staff and teacher and the ability to question during the demonstration.

- Students had less time to wait for instruction or feedback. The waiting time was shortened with the two teacher approach. In addition, checklists for self-assessment were created following tutorial sessions. A strategy was designed that one teacher was available for small groups and individuals at different stages to the majority of the group. This method ensured individuals were not left unattended but could join in a group session if appropriate or they could self-assess their work with checklists that they had been involved in making.
- Students were less dependent on teachers. The self-assessment checklists enabled students to be more independent in their learning.

Pilot study

Results from this shared group experience prompted the teachers involved to consider a study over the full academic year for students in the technology laboratory. The intended study was designed to be over the three terms of the 3rd Year BDS Clinical Dentistry Technology Course. However, it was decided that a pilot study should first investigate and develop the hypothesis of a small group teaching model. The authors wanted to:

1. Develop the students' abilities to self-assess and reflect on their learning.
2. Enable the student to enter into dialogue with their teacher rather than simply be given a lecture in a small group format (Ramsden, 2003, 149).
3. Establish an achievable target for students.
4. Provide an opportunity for student motivation and encourage self-esteem.

The major innovation was to split a normal group size into two with half time in the laboratory and half time in self-study. This initiative was entitled microteaching. Robson (2002) asserted that if possible the first stage of any data gathering should be a pilot study.

The third year class was divided into four teacher groups with two groups receiving teaching with the usual or traditional method and two groups receiving a microteaching method, (Brown, 1975). Although the original microteaching was a teacher-training model that consisted of short sessions of five to ten minutes, video recorded then played back and analysed by the trainee and her supervisor, the authors used the sequences in the model. These sequences were Plan-Teach-Critique-Replan-Reteach-Critique. For the purpose of this study the prepared lesson plan by the teacher would provide background information that would assist in the student's cognitive and affective learning domains development thus enabling student understanding. The student would then be able to utilise their understanding and devote the majority of their time in the laboratory to the development of their psychomotor skills.

Ethical Considerations

An application to the University of Glasgow Faculty of Education ethics committee seeking ethical approval for a non-patient study was sought and granted.

The following features of the study were:

- All students were asked to volunteer to take part in the microteaching approach. Any student not wishing to take part was randomly assigned to a traditional group.
- Students were then allocated into two teaching approaches, the traditional and the microteaching.
- The students' written informed consent was sought prior to the start of the study.

There were 13 students who did not wish to be part of the microteaching method. These students were randomly allocated between the two teachers using the traditional model. The remaining students (*n*=65) who expressed no preference with regard to which method they received were randomly allocated into the four tutor groups. There may have been some selection bias on the part of the students opting out of the microteaching approach. It could be suggested that perhaps 'better' students would elect to participate in the microteaching while the more 'pedestrian' students would opt to stay with the traditional approach. Although there was nothing that could be done on the part of the investigators it is something to consider when analysing he results.

Research method

The microteaching method involved further dividing groups into two micro groups. The number of students in the class was seventy-eight; with thirty-eight assigned to the traditional method and forty assigned to microteaching groups. This enabled micro-taught groups of equal sizes with five in each group.

The traditional groups (n=19, n=18) students used three-hour sessions for a series of continuous assessment tasks and exercises while the micro groups were each taught for one and a half hours during each three-hour session. For the other hour and a half of the three-hour session the microteaching students used lesson plans in a learning outcome focused laboratory manual to assist their preparation for their next laboratory session. The instructors wanted the student to develop a deep approach to learning and considered advance preparation would help develop the students' cognitive learning domain allowing the laboratory sessions to concentrate on developing the students' psychomotor skills domain in small groups. The small group size would enable intensive tuition for each student.

Reflective Journals

All students in the year were invited to keep a weekly journal of how confident and competent they felt about their performance. A simple one to ten score was used to rate confidence and competence. The confidence rating asked the student, 'How confident are you?' either by self-preparation or from the information given by the tutorial and demonstration. The competence rating asked 'How well did you think you performed a task'. The microteaching groups were set targets and given checklists to assist their assessment for the confidence and competence scores.

Members of staff also kept a weekly journal of student competence in the laboratory tasks undertaken. The authors wanted to investigate if there would be a convergence of the scores as students gained understanding. Boud (1999) argued that students could not be expected to engage in good practice in their learning unless teachers adopted a professional attitude in 'the business of fostering learning'.

The reflective journals were analysed by a member of the University's Academic Development Unit, independent from the researchers. The four teachers did not have access to the student journals. The journals were required to be completed at the end of the week and were available for collection at the beginning the following week. The students were informed that their teacher would not see the journals or comments in them and were therefore free to express their thoughts without prejudice.

Teaching methods

Table 1 shows the schedule used for teaching and learning within the microteaching and traditional models. There was more participation for students built into the microteaching approach. In microteaching students participated in peer demonstrations and self-assessment. Peer assessment and group discussions.

Table1 Summary of the differences between the two teaching approaches

Microteaching	Traditional.
1½-hour laboratory session 1½-hour self-study	3-hour laboratory session.
Tutorial	Tutorial
Teacher demonstration	Teacher demonstration
Peer demonstration	Student task
Student task	Teacher feedback
Self-assessment	Continuous assessment mark
Peer assessment	
Teacher feedback	
Group discussion	
Continuous assessment mark	

The methodology used in the microteaching approach compared to the traditional approach included, peer demonstration and assessment and self-assessment using criterion checklists.

Microteaching method

Within the students' lesson plan laboratory manual there were work exercises and also questions to research. The students were required to research each task topic before a laboratory session. Tutorials took on a different format than had previously been

experienced by teachers with more group discussion rather than a monologue from the teacher. During the tutorial sessions the aim of the tasks became apparent with students able to construct checklists of what was required to complete tasks. The students had a target or goal to work to with criteria in the checklists to assist them to achieve an expected standard (Juwah et al, 2004).

Following the discussion of the lesson plan and an explanation of a task, the teacher then gave a demonstration (Cotton, 1995). A student then repeated the procedure in another demonstration. This enabled the group to see what the possible problems were and also helped to clarify any misconceptions about exactly what was required. This was used to address the students' often-stated observation; "it looked easy when you did it". Any questions or queries were addressed and then the students tackled the task. Using the criteria from the lesson plans and tutorials the student was asked to self assess their work on completion of a task.

Students also worked in pairs to review each other's work. Group discussion sessions were held on once per week to review the laboratory sessions and to assist students to reflect of their experience of the week. Continual assessment of their work was carried out which contributed to the student's final grade; in addition, feedback was given to each task. Although students were given a final date for assessment each student decided when they thought the task was ready for assessment, (the student decided when they thought they were ready to be assessed on a given task). The small groups addressed previous student comments that they might have to a considerable wait to receive feedback from their teacher due to the number of students in a group.

Although the time in each laboratory session was half of the traditional method, the smaller group size allowed a more intensive delivery of the course. The course had also been timetabled into small, easy to complete sessions for each laboratory period of the course. This was also seen as a useful development as students would complete a task or stage of a task at every session. The small group format was designed to encourage self-confidence and teamwork and developed interpersonal communication. (Fry, Ketteridge and Marshall, 1999). Fry Ketteridge and Marshall (1999, p.97) citing Griffiths, Houston and Lazenbatt's (1996) report that students described how these skills and others fostered conditions whereby they could observe their own learning

styles, and change them to suit different tasks and engage more deeply with the content of the subject. This is often cited as a prerequisite for deep learning.

Self Study

In addition to the small group format and self-directed study, there were quizzes given to the microteaching groups during the course; the students were not given prior warning about these quizzes. These acted as vehicles for feedback to students on how they were progressing and as a check to teachers that the study time was being used effectively. Following feedback from the quizzes the two staff members in the microteaching method were able to review the lesson plan content and form an opinion of those students whose understanding was less than anticipated. From the early quizzes it was apparent that some students were not using the study time to work effectively with the lesson plans. This was confirmed during group discussions. Those students who had not used the study time appropriately were invited to research the questions they failed to answer and resubmit them. Following the resubmission a feedback and discussion session took place. After a short period it became apparent that an increasing number of students were not using the study time effectively. This persuaded the teaching staff to action a directed study policy in contrast to the self-directed study at the outset. Students were asked to submit work assignments rather than an honour system that had previously been employed. Students did not object to this and some preferred to have direction given.

Traditional method

The traditional method involved a tutorial and explanation of tasks followed by a teacher demonstration. The student then attempted the task with feedback given by the teacher. This method was not as tightly structured as the microteaching method. When the task was finally completed a grade for continuous assessment was given. As opposed to the microteaching method the student in the traditional approach groups relied heavily on when their tutors considered the work was ready for assessment. There was little emphasis on group discussion. Students were not given targets for self-assessment but continued to be heavily dependent on teacher support.

Term Two

In term two, students began their clinical course. This prevented the continuation of the microteaching model, as it required a strict timetable that could not be accommodated during this part of the course. As students were required to undertake their own laboratory work for their patient cases, the demands of the laboratory procedures and the necessity to work to patient appointments were such that teaching for all groups was restricted.

Results

In addition to the qualitative methods of reflective journals and group discussion (discussed below), a quantitative method of data collection was used using marks from written class examinations. The first examination at the end of term was a written exam assessing the students' understanding.

The traditional method (*n* = 37) means score was 55.5 (SD = 9.4) and the microteaching (N = 40) means score was 65.1 (SD = 9.2) (Figure 1). The traditional groups are labelled 1 (*n*=18) and 2 (*n*=19) with the microteaching groups labelled 3 (*n*=20) and 4 (*n*=20).

Figure 1 A box plot distribution of the marks from the first class examination

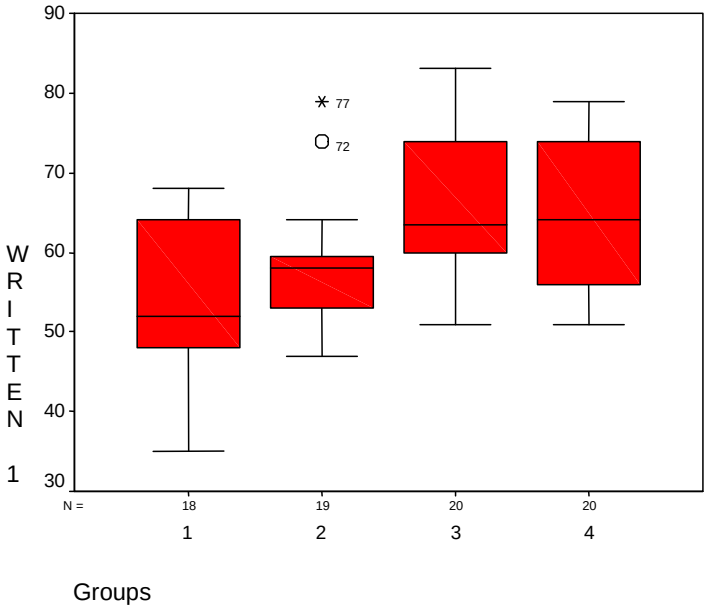

Figure 1 shows the distribution of the marks from the first class examination. The traditional groups are labelled 1 and 2 with the microteaching labelled 3 and 4.

An independent t-test (two sample) was performed that showed that the difference between the groups was highly significant ($t = 4.46$, $df = 75$, $p < 0.01$). Independent t-tests were also performed between each teacher group in both methods to ascertain whether the teachers rather than the method produced a difference. The individual means for the traditional groups were 53.5 (SD =10.2) and 57.4 (SD = 8.4), there was no significant difference found between the teacher groups, ($t = 1.2$, df 35, $p = 0.21$). The microteaching showed a similar result with means of 65.8 (SD = 9.2) and 64.4 (SD = 9.2) and no significant difference found, $t = 0.77$, df 0.47, $p = 0.64$). Although the difference between the two methods was highly significant there was no significant difference between each group within each method.

The range of scores in the traditional method (35 to 79) showed that eleven students scored less that 50. No student in the microteaching groups (range 51 to 83) scored less than 50.

Class Examination Two

A class examination was held at the end of term two using the same format as the first class examination. The microteaching had ceased and teachers were interested to know if students had continued with self-study out of allocated time. The results for the class exam were lower than the first exam with a mean for the traditional groups of 42.1 (SD = 9.3) and the microteaching groups 47.6 (SD = 11.5), (Figure 2).

Figure 2 The distribution of the marks from the second class examination.

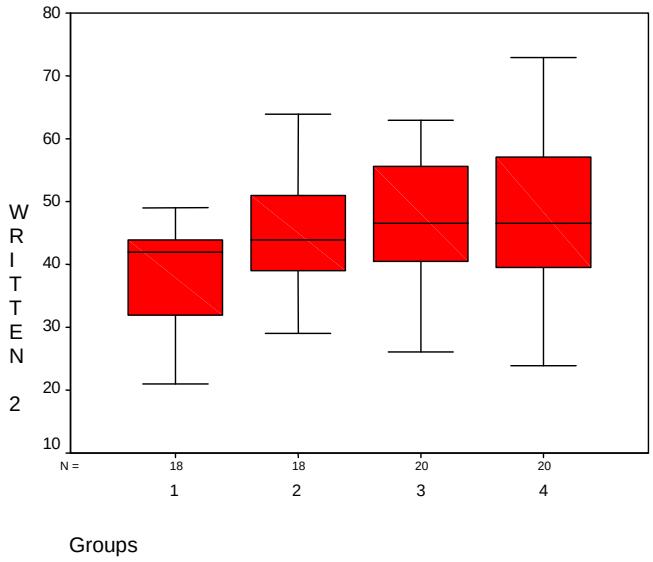

Figure 2 shows the distribution of the marks from the second class examination. The traditional groups are labelled 1 and 2 with the microteaching labelled 3 and 4.

An independent sample t-test found that the difference between the two methods was significant, (t= 2.70, df = 34, p = 0.01). An independent sample t-test was also conducted to find if there was any difference between the teachers in each method. In the traditional method the means were 38.27 (SD = 8.9) and 46.0 (SD = 8.2), an independent sample t-test was also conducted that found the difference between the teachers was significant, (t = 2.7, df = 34, p = 0.01). The means in the microteaching method were 47.3 (SD = 9.7) and 47. 8 (SD = 13.3), an independent sample t-test was also conducted that found no difference between the teachers in the microteaching method, (t = 0.13, df = 38, p = 0.89).

There was a considerable change in the second examination. The mean for the class in exam one was 60%; in exam two this was 45%. The difference between the two groups was much closer than in the first exam. Both groups' means were less in the second exam. The microteaching groups and the traditional method were much closer in terms of scores. The range of scores in the microteaching groups was greater than in the first exam. The range in the traditional groups was similar.

Reflective Practice

Students were asked to rate their confidence and level of competence with each laboratory task completed on a scale of one to ten. Teachers also scored the students' work on a simple 1 to 10 scale. It was decided that this would enable the students to write an unprejudiced account, as their teacher would not see the journal. The journals were also commented on in a Rogerian sense, (Cowan, 1991) by the person reviewing the journals. The purpose of the comments is to try to identify points on which the learners might, with profit reflect – and hopefully the comments made helped in this respect. Cowan (1991) offered four pieces of advice for commenting:

- Prompt rather than direct
- Question rather than challenge
- Brief rather than expository
- Pinpoint something the learner had not thought about before

In commenting on the journals the reviewers made a conscious effort to put these four pieces of advice into action.

The analysis of the reflective journals showed that:

- Students took time to develop a meaningful and truly reflective approach rather than narrative approach to using the journal.
- Preliminary analysis suggested that 'micro taught' had a more meaningful engagement with reflection.
- At the beginning of the course the majority of students over-rated their competence c.f. instructor assessment. Over the period of the course there was convergence between student and instructor assessment of competence.

- The microteaching groups showed a faster rate of convergence – indicating a more accurate ability to self-assess.
- Instructors commented that keeping session-by-session records of student progress gave them helpful insights into student development and how they helped in this regard.

Discussion

In the first two weeks of the course it was apparent that there were students in the microteaching groups who did very little self-study. As a result of this, research questions and written assignments were introduced into the lesson plans that turned this into directed study rather than self-directed study. This was a disappointment for the teachers, as time had been allocated within the student timetable that they did not use for the intended purpose. The decision to include study time within the course addressed students' previously voiced concerns regarding workload and having little time for study (Humphris et al, 2002).

Students in the microteaching groups commented that they had more work to do than the other traditional method groups but it was pointed out that they were being given time for study. For the students in the microteaching method, the introduction of a quiz at unannounced times was unpopular and the standard for the quizzes was initially low. Action taken from this was to ask students to research and resubmit questions that had not been answered. Following the resubmission a discussion and feedback session took place. The results of the quizzes improved as students engaged more with the assignments.

These two examples seem to show that even well qualified (at entry) students need considerable assistance in learning how to learn. Self-directed study seems to be a difficult concept and learners need to have some help initially in how to best use this time in a curriculum.

In conversations with students, teachers elicited that students in the traditional groups thought that as the microteaching students were not in the laboratory they had an easier time as they had more "free" time. Several students did not comply with the instructions given at the beginning of the study, which resulted in an exchange of lesson plans

between the two group methods. Members of the traditional groups said they thought the class exam was biased in favour of the microteaching method because the topics were covered by questions in the lesson plans. The lesson plans were designed around the core material for the course. The core material was available to all students via the Dental School intranet website for e-learning. In an attempt to prevent bias the Head of the Unit selected the questions for the examinations from a pool that all the dental technical teachers involved in both teaching groups had put forward – thus the examination was not biased towards any one group of students.

The reflective journals were evaluated for themes or categories. Evidence from students suggested that the students were not properly prepared for this form of study and indeed might have benefited from an induction of how to write a reflective journal, although 'learning by doing' is perhaps still the only way to develop writing in a reflective manner.

The results of the second class examination were poorer than the first. There had been less time devoted to teaching for both teaching strategies owing to the demands of the clinical patient work. Although the microteaching groups had lesson plans to work from, the micro teaching method and study time ceased. The students carried out study time and any revision for this examination in their own time.

Conclusions

A conclusion from the pilot study was that microteaching could be a useful teaching method as it enabled a comprehensive teaching practice than had been previously taught. In the traditional approach students observed demonstrations and attempted to imitate the demonstration. Teachers in the microteaching approach perceived students were better prepared for the laboratory sessions with the allocation of time for study. Directed study rather than self-study had to be adopted to ensure assignments were carried out. The method used was more labour intensive for staff as lesson plans had to be developed and feedback given on assignments. In addition, there was a repetition for each micro group. The microteaching model also required strict timetabling.

The teacher was able to determine student understanding of each teaching lesson and there was little wasted time for students waiting to have their work evaluated by their instructor with only five members in a group. The development of student's self-assessment and peer group assessment also resulted in less time waiting for instructor feedback. The students were more in control of their learning. We believe this encouraged a deeper approach to learning. The 'micro-taught' students were more independent in their learning. The discussion sessions gave students the opportunity to review the weekly events and provide feedback to the teacher and allow them to reflect on their performance. Assessment of student motivation and performance were more quickly perceived by teachers than previously experienced. The micro-group approach developed a stronger dynamic between teachers and learners. This could be a viable method of teaching and learning for dental students. It addresses the guidelines proposed by the General Dental Council that students have an understanding of technical procedures. The opportunity to develop the system and analyse it more fully by a longer study with more quantitative and qualitative data would enable the analysis of the system with a possible recommendation for teaching dental technology within the dental undergraduate curriculum.

We believe that the current approach of dental students in the University of Glasgow undertaking technical procedures for patients' cases after only a three-month technique course is inappropriate. The class examination results for all student marks were lower in the second examination. The significant difference seen between the two groups in the first exam did continue in the second exam after the microteaching had ceased although the mean marks for both groups was lower.

The reduction of teaching time due to the students attempting laboratory procedures resulted in a lower standard in the second examination throughout the student groups.

Summary of conclusions

- Microteaching can be a valuable teaching approach.
- Directed study produced better results than self-directed study.
- Teaching time is lost due to current clinical arrangements.
- Students' academic performance is affected by laboratory patient work commitments.

- Additional technical staff resources are required from the NHS Trust to undertake the patient service if kept at the same level.
- Students require instruction on keeping a reflective journal.

Acknowledgement

This pilot study was supported by a grant from the Learning and Teaching Development Fund of the University of Glasgow small grants fund. As part of the funding application ethical approval was sought and given by the Department of Education Research Ethics Committee.

References

Adult Dental Health Survey: Oral health in the United Kingdom in1998, Editors Walker, A and Cooper, C. Office for National Statistics. London: The Stationary Office.

Barsby, M. J. (2006) Struggling with Denture Design. *British Dental Journal*, 200, 267.

Basker, R. M. and Davenport, J. C. (1978) A survey of partial denture design in general practice. *Journal of Oral Rehabilitation*, 5, 215-222.

Basker, R. M., Harrison, A., Davenport, J. C., Marshall, J. L. (1988) Partial denture design in general practice – 10 years on. *British Dental Journal*, 165, 245-249.

Brown G. (1975) *Microteaching: A Programme of Teaching Skills.* London, Methuen.

Boud, D. (1999) Avoiding the traps: seeking good practice in the use of self assessment and reflection in professional courses. *Social Work Education*: 18; 2, 121- 131.

Cotton, J. (1995). *The Theory Of Learning Strategy: An Introduction.* London: Kogan Page.

Clark, R. K. F. (2002) The future of teaching complete denture construction to undergraduates. *British Dental Journal*, 193, 13-14.

Cowan, J (1991). Commenting on learning journal entries. *Educational and Training Technology International*: 2; 3, 261-264.

Davenport, J. C., Basker, R. M., Heath, J. R., Ralph, J. P., Glantz, P. O. (2000). *A Clinical Guide To removable Partial Dentures*. London: BDJ publications.

Dentists Act, 1985 Section 27.

Douglas, E. P. (2003) Licensed to practice. *University of Glasgow History of Dentistry Research Group Newsletter*; April, 1-5.

Fry, H., Ketteridge, S., Marshall, S. (1999) *Teaching and Learning in Higher Education*. London: Kogan Page.

General Dental Council (2002) *The First Five Years. A Framework for Undergraduate Dental Education*. 2nd ed. London: GDC Publications.

Griffiths, S., Houston, K., Lazenbatt, A. (1996) *Enhancing student learning through peer tutoring in higher education*, University of Ulster, Coleraine.

Humphris, G., Blinkhorn, A., Freeman, R., Gorter, R., Hoad-Reddick, G., Mutomaa, A., O'Sullivan, R., Splieth, C. (2002) Phychological stressing undergraduate dental students: baseline results from seven European dental schools. European Journal of Dental Education; 6, 22-29.

Juwah, C., Macfarlane-Dick, D., Matthew, B., Nicol, D., Ross, D and Smith, B. (2004) Enhancing student learning through effective formative feedback. York: The Higher Education Academy (Generic Centre).

Lynch, C. D. and Allen, P. F. (2006) Why do dentists struggle with removable partial denture design? An assessment of financial and educational issues. *British Dental Journal*, 2000, 277-281.

McCord, J. F. and Grant A.A. (2000). *A Clinical Guide to Complete Denture Prosthetics*. London: BDJ Books,

Murphy, W. M. (1978) Prosthetic technology teaching in the undergraduate curriculum. *British Dental Journal*; 145, 139-141.

Packer, M. E., Rogers, J. O., Coward, T. J., Newman, P. S., Wakeley, R. (2001). A comparison between videotaped and live demonstrations, for the teaching of removable partial denture procedures. *European Journal of Dental Education*; 5(1),17-22.

Quality Assurance Agency for Higher Education. (1998-2000) Dentistry QO6.

Quality Assurance Agency for Higher Education. (1998) University of Birmingham, Q58/99

Quality Assurance Agency for Higher Education. (1999) University of Bristol, Q44/2000

Quality Assurance Agency for Higher Education. (2000) University of King's College London, Q172/2000

Quality Assurance Agency for Higher Education. (1999) University of Leeds, Q112/99

Quality Assurance Agency for Higher Education. (1999) University of Liverpool, Q113/99

Quality Assurance Agency for Higher Education. (1999) Eastman Dental Institute, affiliated to University College London, Q218.

Quality Assurance Agency for Higher Education. (2000) University of Manchester, Q127.

Quality Assurance Agency for Higher Education. (1999) University of Manchester Metropolitan University, Q69.

Quality Assurance Agency for Higher Education. (1998) University of Newcastle Upon Tyne, Q25/99

Quality Assurance Agency for Higher Education. (2000) Queen Mary and Westfield College, Q252/2000

Quality Assurance Agency for Higher Education. (1998) The Queen's University Belfast, Q4/99.

Quality Assurance Agency for Higher Education. (2000) University of Sheffield, Q284/2000

Ramsden, P. (2003) *Learning to Teach in Higher Education*. 2nd ed. London: Routledge.

Robson, C. (2002). *Real World Research.* 2nd ed. Oxford: Blackwell.

Stafford, G. D., Glantz, P-O, Harrison, A., Murphy, W. M. A. (1982) A comparison of some aspects of dental technology in commercial laboratories in England and Sweden. *Swedish Dental Journal*, 6, 81-86.

Todd, H. F. (1977) The History of Dental Instructors. Unpublished manuscript presented at the 8th annual conference of the Society of University Dental Instructors: Manchester.