

Teaching Methods for the Facilitation of Developing Skills

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Abstract

Three teaching methods are investigated for teaching cavity preparation and to develop skills. Students of equal ability were randomly assigned to three groups. The experimental task was to prepare a Class II cavity preparation for amalgam. Group I was instructed to prepare their tooth using a conventional method of instruction. Group II was instructed using a diminishing cues method and Group III was instructed using a step-by-step modeling procedure.

All work was collected in coded envelopes and evaluated by an experimenter using the same criteria provided to the students. Two weeks after the experimental task, a performance task was administered to each group in order to measure the degree of skill retention. Students were provided criteria sheets and notes only. The performance task was evaluated in the same way as for the experimental task. Results show that the step-by-step modeling method is the most effective method of teaching cavity preparation skills.

Introduction

Since the turn of this century, dental education has made great strides in providing comprehensive care for our ever growing population. In order to continue the momentum for a quality health service, dental schools must continuously seek out methods of teaching which will provide future clinicians with the best possible training to meet their responsibilities. Each generation offers new challenges and problems to our health science personnel. The dental educators are aware that our society is constantly changing, and the techniques for developing clinical skills necessitate a dynamic approach toward education.

According to McKeachie, there are numerous studies which show that the lecture method compares favorably with conference or seminar methods in terms of knowledge retained.¹ Most of these studies were conducted in courses which were basically knowledge type courses rather than courses which emphasized the development of skills. The oldest method of teaching skills is the demonstration-performance method. Briefly, the method involves presentation of some sort of background information, followed by a demonstration of a technique, followed by the performance of the same technique by the learner. Blancheri and Merrill have found that both learning and retention were enhanced when a procedure was broken into small segments and students permitted to perform one segment before receiving instructions regarding the next.² Lawther also makes the point that retention is improved when the task is practiced in short sessions.³

In the late 1950's and early 1960's, dental educators began to seriously explore a variety of media, attempting to develop more effective methods of teaching dental skills. Television was used as a teaching medium in dental school, and it meant that a laboratory procedure could first be perfected and then presented over and over again. Bandura reports that the incidence of modeled responses was slightly higher for film presentations than for live models.⁴ Starkey and Doehring described the use of a tape-slide sequence for dental technical work which proved successful.⁵ This method was essentially demonstration-performance, and others have had success with this method or similar ones.

Other approaches toward modifying dental educational instruction were investigated by McCrea and Swanson.⁶ They found that formal lectures could be

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dispensed with if the replacing program was well organized. Lumsdaine investigated the diminishing cues method of instruction utilizing the theory that a large number of technique cues would provide a student with a better armamentarium for developing his clinical skills.⁷ The results of this study showed that the students performed significantly better than those subjected to traditional methods of instruction.

The purpose of this study were:

1. to determine which of three teaching methods (conventional, diminishing cues, and step-by-step modeling) was most effective;
2. to determine if there were significant differences in the subjects' retention of information.

Methods and Materials

The subjects for this study were 50 first-year female dental hygiene students who, although in a field related to dentistry, had received no prior experience with cavity preparations. In order to obtain comparable groups, students were assigned a preliminary task. The experimenter then scored the students' work and randomly assigned students with equivalent performance score levels to each of the three treatment groups. Group 1 received the conventional method; group 2 received the diminishing cues method; and group 3 received the step-by-step modeling method. The study consisted of three distinct phases: a preliminary task, the experimental task, and the performance task (retention period).

(I) The first preliminary task was to prepare a simple (Class I) preparation for amalgam on a dentof orm tooth. Prior to beginning the task, the experimenter delivered to the students an illustrated lecture explaining the principles involved, including specific techniques. Each of the students was given a sample preparation which could be used for comparison purposes. The students were also provided with drawings and criteria sheets to aid in evaluating their work.

(II) The experimental task was conducted one week after the preliminary task and involved skills similar to those required to complete the preliminary task. TV tape was used to provide the students of each of the three groups with the information the experimenter wished them to have. The experimenter delivered a lecture which outlined the principles involved in a Class II preparation. At the end of the experimental task, the students were given their group assignments. The assigning of the students was either in the Group I (the conventional method), Group II (the diminishing cues method, or Group III (the step-by-step modeling method). Regardless of the teaching method, each student worked on the same tooth and was re-

quired to produce the same type of cavity preparation.

A. Conventional Method — By means of TV taped instructions, the students were presented with an introduction to the task and were also given instructions on how to check each criterion item on their list. The students were told to make their preparations using their notes, handouts, and criterion model (Figure 1).

B. Diminishing Cues Method — Students using this model were given an introduction to the task including an explanation of the dentof orm teeth they were to use. The experimenter also demonstrated how to use the criterion sheet. Figure 2 shows the criterion model and the three teeth (one preparation nearly complete, one approximately half complete, and one with a preparation barely started) received by each student.

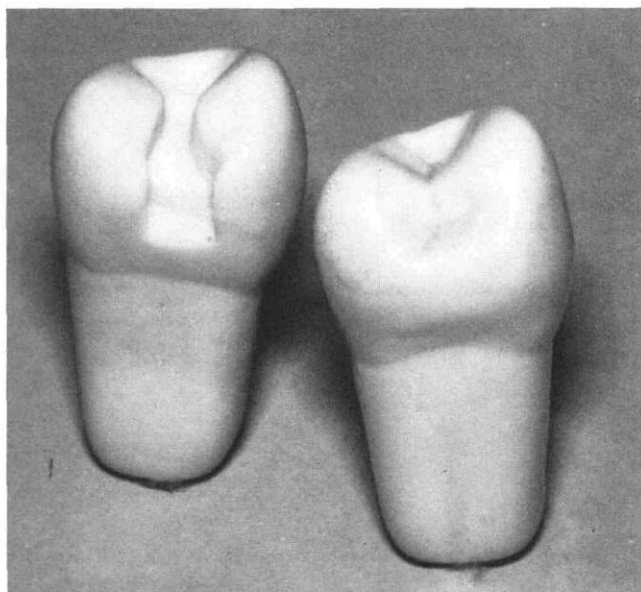


Figure 1. Conventional Method — Unprepared tooth and criterion model.

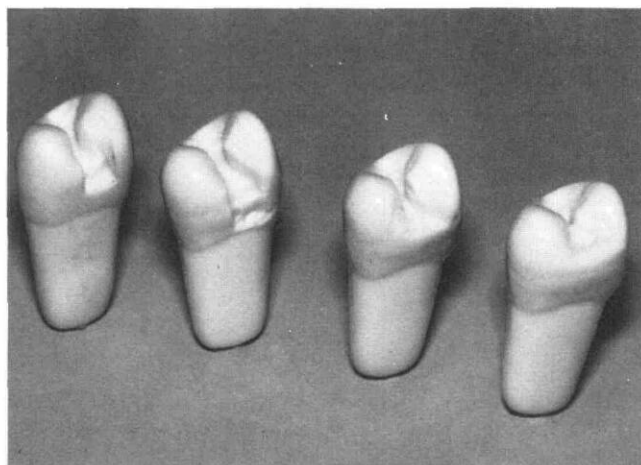


Figure 2. Diminishing Cues Method — Criterion model and the three teeth received by each student.

C. *Step-by-Step Method* — As with group 1 and 2, this group received a TV introduction to the project. From this point on, the taped instructions were very explicit, proceeding in a step-by-step modeling fashion. A small portion of the task was demonstrated, after which the students were asked to perform the same step. At the completion of each step, the criterion item was discussed and the students were shown how to check their work using the criterion sheet. The tape was stopped after each step was presented and resumed when three-fourths of the students had completed the steps.

D. *Performance Task (Retention Period)* — One of the research questions involved the effect of the three teaching methods on retention which was defined by this study as the student's ability to accurately replicate the assigned task after two weeks. There was no advance notice of this task so that the students could not practice for it.

The task assigned was to make a Class II cavity preparation on a tooth in the left side of the mannequin. Students were not provided with criterion models or TV instructions. They were encouraged to use their criteria sheets from the previous task. Students were allowed 45 minutes to complete this performance task. The experimenter directed the students to turn in their work in the sealed, coded envelopes provided. Code numbers varied so that the experimenter could not refer to previous numbers. Evaluation of the performance task was accomplished by the experimenter using the same criteria and methods as were used to evaluate the experimental task.

Results

1) Upon completion of the preliminary task, the students' work was evaluated. The point values ranged from a high of nine to a low of three. Students were matched based on three scores and randomly assigned to one of three groups. There were no significant differences between the initial treatment groups (Table 1).

Table 1. Mean Scores and Standard Deviations of Preliminary Task Scores of the Three Treatment Groups.

	Group I	Group II	Group III
n	n=18	n=19	n=13
Mean Score	5.94	6.11	6.15
Standard Deviation	1.47	1.94	1.57

2) The cavity preparations produced by the students for the experimental task were also evaluated by the experimenter. A coding system was used to label the preparations. Since the preparation on the proximal area was new material to all subjects, only the evaluation criteria which pertained specifically to the proximal area were used to evaluate the subjects work.

3) The results of the performance task (Retention) were evaluated by the experimenter using the same criteria as for the experimental task. Table 2 shows the mean scores and the standard deviations of both the experimental and performance task derived from the scores of the cavity preparations produced by the subjects who received one of the three teaching methods.

A repeated-measures 3 x 2 analysis of variance (unweighted means) was used to compare the differences of the mean scores of the experimental task and the performance task (Retention) of cavity preparations produced by subjects associated with the three teaching methods: the conventional method, the diminishing cues method, and the step-by-step modeling method.

Table 2. Mean Scores and Standard Deviations of the Experimental Task and Performance Task for the Three Groups

		Group I n=18	Group II n=19	Group III n=13
		Conventional	Diminishing	Step-by-step
Experimental Task	Mean	5.89	6.74	7.39
	SD	2.17	1.28	0.96
Performance Task	Mean	4.72	4.95	6.46
	SD	1.49	1.43	1.51
Combined Task	Mean	5.31	5.84	6.92
	SD	1.83	1.36	1.24

4) The F values show that there were significant differences in cavity preparations following the three methods of teaching cavity preparation. Performance task (Retention) scores of the three groups differed significantly. The interaction was not significant. The drop across the two week time span appears to be much less for the step-by-step modeling method than for the other two methods of teaching.

5) The Newman-Keuls test was used to compare the three teaching methods. Because of unequal sizes, the harmonic mean of n's was used. Comparison of Groups I and II revealed no significant difference at the .05 level. Comparison of Groups II and III revealed the step-by-step modeling method to be significantly superior to the diminishing cues method ($CR_{N-K} = .95, P < .01$). The step-by-step modeling method was also significantly superior to the conventional method ($CR_{N-K} = 1.08, P < .01$).

Discussion

The results of this study show that the step-by-step modeling method enabled students to produce significantly better work than either the diminishing cues methods or the conventional method. Examination of the proximal area scores for the three groups also shows highly statistically significant differences between groups. From these data, one must conclude that it was the step-by-step modeling treatment received by Group III which enabled this group to retain more information, and therefore, to produce cavity preparations which more closely met the stated criteria.

To minimize the "Hawthorne effect" on the part of the subjects, they were not informed that their assignment was part of an experiment until after completion of the final phase (Performance task) of the study. This experiment was conducted without instructor comment to preserve the validity of the experiment. It may be assumed that student-faculty contact would be desirable for both clarification and feedback under normal working conditions.

The task required of the subjects of this experiment is usually introduced to Temple Dental School freshman after nine half-day sessions in operative dentistry. At the start of this experiment, the subjects were unfamiliar with much of the equipment to be used and also had no knowledge of the principles of cavity preparation. If these subjects were capable of producing acceptable preparations with a minimum instruction, it seems likely that the step-by-step modeling method can be developed to guide dental students through similar cavity preparations with a higher level of skill and judgement.

Conclusions

Professional training constantly builds on previous information; since it is difficult to alter an established

pattern, the foundation courses must be well laid. Students taught by the step-by-step modeling method achieved higher scores (quality) and with greater retention of knowledge than students taught by the other two methods.

The findings of the experiment would seem to suggest that the step-by-step modeling method should be developed for use in dental schools. Results could benefit the school by freeing curriculum time, by making more time available for new course development, by allowing for more research, or by permitting additional faculty-student contact.

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