

**WHAT FACTORS INFLUENCE LEARNING OF
PSYCHOMOTOR SKILLS BY DENTAL
STUDENTS?**

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Abstract

Several key factors have been identified that relate to skill acquisition: a) ability, b) motivation, c) thinking processes and d) learning environments. Other health professions have used learning theories to inform study designs when investigating skill acquisition but this approach has not been adopted routinely in dentistry. Previous studies in dentistry have focused mainly on the predictive value of assessments used in dental admissions, eg ability tests, rather than trying to clarify how factors such as motivation and ability influence skill learning. This dissertation explores the influence of the above key factors on dental performance and outlines theoretical-based implications for practice in operative technical courses.

To clarify how motivation, ability, thinking processes and learning environments influence the acquisition of psychomotor skills in operative dentistry, two cohorts of dental students were studied from different years of the Bachelor of Dental Surgery program at The University of Adelaide. To determine the nature of the relationship between individual differences in ability, motivational determinants and performance on routine operative dentistry tasks, a cross-sectional study (Phase I) was conducted of third-year students. Phase I also investigated the use of motor learning parameters by students during completion of a routine operative task.

The second phase of the study investigated individual differences in ability of a different cohort of students and was carried out during the second year. This was achieved by exploring the contribution of ability and motivation determinants to changes in motor performance throughout the operative technique course. The study also explored external factors that were related to performance, ie learning

experiences that students reported had influenced their skill learning, as well as motor learning parameters they used during the activities.

Both quantitative and qualitative approaches were used to explore the previously noted key factors using a range of instruments, eg psychometric tests, a motivation survey, a retrospective think-aloud technique and critical incident reports. Significant positive associations were found between cognitive, psychomotor and motivation scores and performance in operative dentistry. This relationship varied across different stages of learning in the dental program. Students tended to focus on evaluating their outcome rather than evaluating their processes to achieve a task. Three themes related to learning environments were derived from critical incident reports and follow-up interviews: roles of tutors in providing a positive learning environment; perceptions about the quality of cavity preparations, ie “learning from errors”; and roles of peers in self-assessment of outcomes.

This study has provided insights into individual differences in the learning of psychomotor skills by dental students as a result of inherited factors, eg ability, as well as the roles of the learning environment in enhancing learning. This dissertation presents the implications of these findings for the design of quality learning activities in operative technique courses.

Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution to Nattira Suksudaj and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Nattira Suksudaj

Dated this.....day.....2010

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Summary

The acquisition of psychomotor skills is clearly a key competence in dentistry and also in other health profession areas, such as surgery. Several significant factors have been identified that can influence skill acquisition. Recently, skill acquisition and motor learning theories have been used to improve understanding of skill learning in surgical training. However, our knowledge of key factors associated with the development of psychomotor skills in dental education is inadequate. Specifically, research into psychomotor skills shows limited application of the theory of skill acquisition in study designs. As a result, our understanding of the roles of key factors in skill acquisition in dentistry is incomplete.

Key factors that have been reported to influence psychomotor skill acquisition include a) internal factors, eg level of motivation, ability and learning processes, and b) external factors, eg the learning environment or setting experienced by learners during practice which will also be referred to as 'the practice environment' in this dissertation. Therefore, the purpose of this study was to clarify differences in performance among dental students in relation to internal factors in skill learning. In addition, the study aims to clarify aspects of the practice environment that support students' learning of skills. Therefore, the two main research questions for the current study are; a) what is the relationship between performance on operative skills and internal factors, eg motivation, ability and learning processes, and b) what learning activities do students perceive to be effective or ineffective in supporting their learning. The first research question should provide insights into understanding how motivation is associated with different levels of performance and which key abilities

are required in learning dental skills. In addition, an understanding of students' learning processes should assist in clarifying differences in performance during completion of an operative task. Furthermore, this information should be useful for design of learning activities to optimise outcomes. The second research question should help us to identify aspects of the practice environment that enable positive learning experiences.

To explore these research questions, the current study was conducted in laboratory classes as part of an operative technique course (see Chapter 2: Methods). This involved a cross-sectional study with two cohorts of students, third-year (Phase I) and second-year (Phase II) students. Research techniques and materials were selected based on a range of sources of validity evidence (results presented in Chapter 3) to ensure valid interpretations of the data collected. Chapter 4 presents results on the relationship between dental performance and ability and motivation for both cohorts. Chapter 5 presents results on the use of motor learning parameters by students during completion of an operative dental task. Finally, Chapter 6 presents results on students' perceptions of effective and ineffective aspects of the practice environments in an operative technique course.

For the first research question, a relationship between dental performance and motivation, as well as ability, was noted. This relationship depended on the stage of learning, which was somewhat consistent with skill acquisition theory. Specifically, performance by students in second year was associated with broad-content cognitive ability while the performance of third-year students was influenced by psychomotor ability. Those aspects of this research question relating to motivation and ability were answered but the limitations of the study need to be acknowledged (Chapter 7, section

7.7). In summary, motivation and ability, including both cognitive and psychomotor ability, appear to be key factors that influence learning outcomes in operative dentistry. Furthermore, the current study explained the learning processes that students use during completion of an operative dental task. Similar patterns of learning processes were reported among students with variable levels of performance. These results highlighted key learning elements students used during the dental task. Future studies should focus on the design of activities that make use of students' motivation as well as identification of key learning processes used in operative dental tasks to improve performance.

For the second research question, the current study highlighted both effective and ineffective learning experiences from the students' perspective. Students acknowledged the role of tutors in supporting skill learning in the operative technique course. For example, effective learning experiences were noted when tutors arranged group discussions on 'how to do' the exercises. Ineffective learning experiences were noted when students were unsure and became stressed about their knowledge base. Future studies involving various interventions are needed to determine which learning experiences encourage better performance among students.

In summary, the current study provides new insights into factors that influence learning of psychomotor skills in operative dentistry and also suggests how dental educators could apply the findings when designing operative activities (Chapter 7, section 7.8).