Teaching and Learning with Touch Technologies in Dental Education

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Background
Although 10 years of research studies have shown that haptic simulators have significantly enhanced the teaching of skills involving touch control and hand-eye coordination in Dental Education, there are few studies to date evaluating the teaching approaches which enable the effective integration of using haptic simulators into the undergraduate dental curriculum.

Aim
The aim of this study were to analyse the student performances in different laboratory settings and teaching techniques used over a ten-year period for the use of the hapTEL simulators in teaching undergraduate BDS students.

Materials and Methods

Educational Settings: hapTEL laboratory with 6-12 hapTEL Virtual simulators (Figure 1); students working in pairs to remove caries from Class 1 cavities; plus 2008-2011 Traditional Phantom Head Lab.

Student year cohorts ranged from 112 – 124, divided into tutor groups of 24 (2008-2011) Traditional Phantom Head Lab.

Teaching strategies: Varied from 1-hour long lecture followed by 1.5 hours hapTEL session supported by tutors and a technician, to online introductory group tutorial/demonstration followed by one 1.5 hour session (S1) and one 1-hour session, 2-3 weeks apart. Students working in pairs were taught to trouble-shoot the hapTEL work-station. See Figure 3.

Their learning progression was measured by pre and post-assessment tests (2008-2011) and log files of caries removed and healthy tissue remaining (2010 – 2017).

Results

- hapTEL trained students did equally well as traditionally trained students.
- Students needed ongoing support during sessions to optimise the benefits of the learning activities.
- Students needed systematic procedures to record and submit their hapTEL log-files
- Extensive ongoing support for teachers in a blended learning format is needed to maximise its potential.
- The use of the hapTEL simulators was found to be most reliable (fewest technical issues) when the students were taught to trouble-shoot the devices themselves.
- The online tutorial/demonstration strategy provided the best preparation for the students to use the simulators. There was consistent improvement in the students’ fine motor skills and caries removal (% of caries removed, healthy tissue remaining, exposing the pulp).

Conclusions
The effectiveness of using haptic simulators to teach clinical relevant skills will depend upon the teaching and learning strategies used; the most effective being a blended learning approach and maximising the student ownership and responsibility for the learning and assessment tasks.

References

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Figure 1: The hapTEL System developed by the hapTEL project
Figure 2: hapTEL and traditional Phantom head settings
Figure 3: Log-File assessment procedures for student performance and feedback