Mixed-method assessment of deep learning in fourth-year dental students

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1 PROBLEM

Midway through the spring 2020 semester, the COVID-19 pandemic led to a state emergency order that the university convert all courses to distance learning and the dental clinic close for all but emergency procedures. The emergency shutdown continued beyond the semester end. At the time of the shutdown, 22% (n = 25) of fourth-year DDS students still had not completed the required foundation restoration (FR) competency exam—traditionally administered on a patient in the clinic environment. The challenge, therefore, was to swiftly develop and deploy innovative clinical assessment methodologies that would allow students to demonstrate competence in the required clinical procedures prior to graduation.

2 SOLUTION

How, then, to assess clinical competence? A mixed-assessment method of deep learning1,2 was implemented to evaluate the attainment of clinical competence while engaging students in a meaningful learning experience. Specifically, the discipline monitor (DM) developed an alternative comprehensive assessment (ACA) experience allowing students to demonstrate FR clinical competence prior to graduation. The DM completed an initial feasibility and resource estimate, revealing the need for additional faculty involvement and expanded physical space to satisfy COVID-19 social-distancing mandates and recommendations.

The ACA involved completion of a structured viva voce examination (VVE)3 and simulation-based4 experience. The VVE consisted of 13 image-assisted questions addressing various approaches to restore endodontically treated teeth. This section evaluated the knowledge, clinical reasoning, problem-solving, and decision-making readiness of each student, who elaborated verbally on the diagnosis, treatment-planning, and clinical procedures involved in the restoration of endodontically treated teeth. One faculty member evaluated each student.

The simulation-based experience involved a foundation restoration for a vital tooth. Students were provided with a clinical scenario which included patient demographics, medical status, clinical pictures, and a description of a chief complaint of a fractured cusp on tooth #30 (Figure 1). Students answered questions related to required diagnostic data prior to initiating treatment. Tooth #30 was diagnosed as vital based on diagnostic data (Figure 2). Students described subsequent clinical steps, which included local anesthesia, rubber dam isolation, removal of existing amalgam restoration, and evaluation of residual tooth structure.

The students were then presented with a pre-prepared typodont tooth resembling the patient’s tooth (Figure 3), and asked to describe the fundamental tooth preparation elements necessary for placement of an amalgam FR. Following one-on-one discussion with faculty members and demonstration of local anesthesia technique, the students proceeded with tooth modifications on the manikin. Tooth modifications included flattening the pulpal floor, removing an undermined cusp, enhancing proximal box form, groove incorporation, and pin placement (Figure 4). Finally, students completed a detailed chart entry inclusive of the ADA dental treatment code(s).

Faculty evaluators assessed student performance against a detailed rubric. The 4 participating faculty evaluators
Clinical Scenario

- 47 year old male
- Medical Hx: non-contributory
- BP 123/77  Pulse: 65
- CC "my tooth is chipped and I was told I need a crown"

**FIGURE 1** Simulation-based experience: patient box and clinical picture

Endodontic screening and periapical radiograph confirmed tooth vitality. Describe your next clinical steps.

**FIGURE 2** Simulation-based experience: diagnostic data indicating the tooth is vital

attended a training session conducted by the DM to review use of the rubric and best practices on how to conduct the *viva voce* and simulation sessions.

### RESULTS

Based upon informal feedback, faculty felt the alternative assessment was comprehensive, reflected the students’ level of knowledge, and demonstrated student skills essential for completing the procedure. Similarly, students (n = 21) reported that the assessment modality was successful and valuable (85%) and a fair alternative to the actual clinical procedure. Moreover, students suggested including this educational experience as part of the course going forward in order to augment preclinical training. Overall, the ACA experience created an educational environment conducive to the assessment of deep learning and higher-order thinking within the context of the related competency.

### REFERENCES

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**FIGURE 3** Simulation-based experience: pre-prepared typodont tooth

**FIGURE 4** Simulation-based experience: completed tooth preparation

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