Commentary

Balancing assessment of depth and breadth in the dental curriculum: A bi-dimensional assessment strategy

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ABSTRACT

Introduction: Integrated curricula are being increasingly adopted in health professions, owing to their advantages including patient-centred training and development of critical thinking. Similarly, the majority of dental Universities have either moved away from discipline-specific towards integrated curricula or have incorporated elements of integration. Despite several advantages offered by the integrated curriculum, one disadvantage is failure to assess depth of knowledge. Assessing the depth of knowledge is a characteristic of discipline-specific curriculum. This commentary describes the inclusion of both discipline-based and integrated assessments at Faculty of Dentistry, SEGi University, Malaysia.

Material and methods: Module tests (discipline-based assessments) comprising of discipline specific questions are conducted at the end of every term, mimicking the traditional discipline-specific assessment. Questions in the module tests are intended to assess the depth of knowledge of students. Mid semester examinations are conducted at the end of the semester, mimicking the integrated assessment. Integrated questions are intended to test the breadth of knowledge of students.

Results: Lecturers and students felt introduction of module tests, helped them to prepare for topics in a phased manner and better answer questions posed by lecturers during case discussions and clinical presentations. The 'borderline distinction' students felt that studying for module tests provided them with the depth of knowledge essential to answer questions during viva voce.

Discussion: Including both the traditional and integrated methods of assessments would engage students in a learning experience developing their breadth and depth of knowledge. Further prospective research is essential to assess the impact of this assessment strategy.

1. Introduction

The majority of the Universities offering courses in health profession have adopted an integrated curriculum, whereas others are either discipline-specific or have incorporated some elements of integration into their curriculum.¹ A similar trend is observed in the Universities offering dental education, with majority of the Universities either following an integrated curriculum or having some elements of integration in their curriculum.² The advantages offered by the SPICES model (student-centred, problem-based learning, integrated, community-based, elective, and systematic/apprenticeship-based) proposed by Harden et al. are the reasons for adopting the integrated curriculum.³ Literature suggests that an integrated curriculum teaches and assesses higher order thinking (synthesis, analysis, formulation, and evaluation)

enabling students to seek meaningful connections between disciplines to develop and value multiple perspectives.³ Advantages include patient-centred comprehensive care, assessment using real-life patient scenarios/episodes prepares the student to real-life situations, and development of critical thinking.^{1–3} However, one of the criticisms of the integrated curriculum, is that it often fails to address the fundamental aspects to be learnt in some specialties.²

Ivanitskaya et al. asserts that the integrated curriculum falls short of building and evaluating the students' single-discipline depth of knowledge.⁴ As integrated curricula focus primarily on the breadth of knowledge, the specific discipline depth of knowledge may be compromised. However, there is also evidence that the same subject content taught in an integrated curricula covered greater breadth compared with discipline-specific curricula.⁵ This commentary describes the move

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by the Faculty of Dentistry, SEGi University, Malaysia to incorporate discipline-based and integrated assessments to assess breadth and depth of subject contents in its Bachelor of Dental Surgery (BDS) programme.

2. Methods

The BDS program offered by the Malaysian Dental Universities including Faculty of Dentistry, SEGi University, Malaysia uses an outcome-based approach, so that each part of the programme strives to achieve certain specific goals or educational objectives.⁶ The educational objectives for the dental curriculum aims to produce i) knowledgeable and technically competent dental surgeons who strive for quality and excellence in dentistry through engagement in continuing professional development and life-long learning; ii) dental surgeons who contribute to society through social consciousness and responsiveness to the changing oral health needs of the community; iii) dental surgeons who function effectively in a dental team and with other health professionals; iv) dental surgeons who adhere to the standards of professional conduct and ethics.⁷ The BDS program at SEGi University, Malaysia is a five-year dental undergraduate program, following an integrated curriculum, taught within outcome-based teaching-learning strategy.

3. Rationale for assessment of depth and breadth in dental curriculum

With the implementation of integrated assessments since 2015 some faculty members perceived that students lacked fundamental knowledge and in-depth understanding of certain concepts in specific disciplines. Take, for example, the Modified Essay Question (MEQ) that integrated aspects of three clinical dental specialities – Prosthodontics, Periodontics and Endodontics (Table 1).

From the given sample MEQ, it is evident that the questions asked are specific to the case scenario, with conscious efforts to avoid cueing. The various subject experts involved in the question building perceived that the questions lacked depth in evaluating some of the fundamental aspects of their speciality areas. For instance, from an endodontic point of view, it was important to assess a student's knowledge on the diverse nature of underlying endodontic microbiology – the bacterial pathways communicating pulp and periodontium, types of endodontic infections, biofilm formation, methods of microbial identification, post-treatment sequelae and so on. Despite the MEQ in Table 1 focusing on endodontic and periodontal infections, it was difficult for the question writers to insert questions from these areas into an integrated question, at the place of broader questions connecting other specialities.

In health-related disciplines, depth of understanding of a particular topic is essential and decisions of clinicians regarding diagnosis or treatment plan may often be dependent on his/her depth of knowledge or concepts around a specific topic. The apparent issue of concern was that integrated assessments led to evaluation along the breadth of the topic, while evaluation of the depth of knowledge was not feasible, considering the time, energy, cost and resource constraints associated with these assessments. If assessment drives teaching and learning among students, inclusion of assessment methods that tests both breadth and depth of knowledge would be a valuable addition. Assessing both breadth and depth of knowledge among students, ensures a multi-dimensional strategy, instead of a traditional one-dimensional strategy (Fig. 1).^{8,9}

4. Description of the assessment format

An academic year of the BDS program at the Faculty of Dentistry, SEGi University has 43 teaching weeks split into two semesters, each consisting of 21–22 weeks. At the end of each semester, students are summatively assessed for their theoretical knowledge and a measure of clinical skills. In the course of the two semesters, students are also

Table 1

A Sample Modified Essay Question integrating Aspects of Three Clinical Dental Specialities.

A 45-year-old Chinese male presented at your clinic complaining of purulent discharge in the right lower back tooth region. He has been under medication for diabetes mellitus for the past 10 years. Intra-oral examination found a draining sulcus and sinus tract in relation to tooth 46, which has been heavily restored. Pulp sensitivity tests recorded no response. Basic Periodontal Examination scores were 3, 2, 3 (right to left) for the maxillary sextants and 4, 2, 2 (right to left) for the mandibular sextants. There were periodontal pockets of 10 mm at both the distobuccal and distolingual aspects of tooth 46 with pus draining into the sulcus. Probing of tooth 46 with a Naber's Probe found a grade II furcation involvement. A cervical enamel projection was evident on the buccal furcation region. The intra-oral periapical radiograph of tooth 46 is provided.

A	Classify the presenting Endo-Perio lesion in this patient from the given clinical and radiographic findings. Justify. [C4]	4 marks
B	Formulate an appropriate treatment plan for this patient. [C4]	6 marks
You gave an appointment for root canal treatment of tooth 46. After access opening, you encounter difficulty identifying the root canal orifices.		
C	List five (5) techniques you would use to locate the root canal orifices in tooth number 46	5 marks
D	Explain the association between the patient's medical history and the prognosis for his endodontic and periodontal therapy.	5 marks
E	With 48 being mesially tilted and still vital, elaborate on the challenges you would face in fabricating a fixed partial denture with 46 and 48 as abutments.	10 marks

formatively assessed in their clinical skills to identify areas of weaknesses for rectification. Formative assessments for clinical competence are not discussed here, as they are beyond the scope of this commentary. Students were given information about the discipline-specific examination (named as module tests) and the rationale for the introduction of such an examination.

Assessment of theoretical knowledge is carried out using assessment tools like Modified Essay Questions (MEQs), Short Answer Questions (SAQs) and Multiple Choice Questions (MCQs). Practical and clinical skills assessing the three domains of cognitive, psychomotor and affective, are summatively assessed using Objective Structured Clinical Examination (OSCE). Although similar assessment formats are used for all the preclinical and clinical years, for the purpose of this commentary, the assessment format practiced for the Clinical Dental Practice (CDP) course for year 5 BDS program is elaborated. The CDP course encompasses teaching, learning and assessments in six clinical dental specialities - Periodontics, Endodontics, Prosthodontics, Oral Surgery, Paediatric Dentistry and Orthodontics. The assessment structure practiced is shown in Table 2. At the end of each semester, summative assessments are conducted in an integrated format. The specialists from each of the six disciplines, contribute 6 MEQs, 18 SAQs, 30 MCQs and 12 OSCEs. The question writers are instructed to include aspects of two or more specialities in each question, especially for the MEQs and OSCEs. The end-of-semester summative assessments aim to test the students' 'breadth' of knowledge across all six disciplines.

In 2017, the Faculty implemented an assessment structure that incorporates both traditional discipline-specific and integrated curricula. In the middle of each semester, exclusive module tests are conducted in the six disciplines. Questions are discipline-specific, and are exclusively framed and vetted by subject experts to test fundamental knowledge and depth of understanding of the student for each specialty discipline.

Fig. 1. Assessing depth and breadth of knowledge creates a multi-dimensional strategy, whereas assessment of only depth or breadth results in a Uni-dimensional strategy.

Answers to the module test or general feedback on the performance was provided a week after module test. A comprehensive tabulation of the features of integrated assessments and discipline-based assessment (module tests) is shown in Table 3.

5. Feedback and evaluation

Student responses for the new module tests (MT) were collected using evaluation questionnaires as part of regular student feedback for teaching and learning. The University as a whole also has a ‘Staff-Student Consultative’ system wherein students reflect on the academic sessions including teaching - learning, popularly called “reflections”. These sessions, which are minuted, are held twice per semester attended by the Dean and senior members of the faculty. Feedback was also collected from the students in the form of informal interviews through the existing mentor-mentee system of the Faculty.

Students felt that the module tests at mid-semester, in a way, ‘forced’ them to study the topics in a phased manner, allaying their natural tendency to cram all the studying at the end of each semester. The module tests also tested their knowledge in each specific subject as opposed to the end-of-Semester examinations that require them to think ‘across’ the different subjects. Preparing for module tests equipped them to better answer questions posed by lecturers during case discussions and clinical presentations. In the Professional Examinations, students scoring overall marks of 77 - < 80% are invited for viva voce to gauge whether they should be considered for a distinction. These ‘borderline distinction’ students felt that studying for the module tests provided them with the depth of knowledge essential to better answer questions posed during viva voce, as questions of increasing complexity and depth are posed by the examiners. Overall, there were positive feedbacks from students on the incorporation of mid-semester module tests showing acceptability.

Table 2

The assessment structure followed at Faculty of Dentistry, SEGi University, Malaysia. At the end of the every term, discipline-specific assessments are done, whereas mid-semester and professional examination are in integrated format.

Semester I				Semester II			
Week 01 to Week 10	Module Test (Summative) <i>Discipline-wise assessment</i>	Week 11 to Week 20	Mid semester Examination (Summative) <i>Integrated assessment</i>	Week 01 to Week 10	Module Test (Summative) <i>Discipline-wise assessment</i>	Week 11 to Week 20	Professional examination (Summative) Integrated assessment
	1 MEQ 2 SAQs 5 MCQs ★ 6 specialities		MEQ (6)* SAQ (18)* MCQs (30)* OSCE (12)*		1 MEQ 2 SAQs 5 MCQs ★ 6 specialities		MEQs (6)* SAQs (18)* MCQs (30)* OSCEs (12)*
MEQ - Modified Essay Question, SAQ - Short Answer Question, MCQ - Multiple Choice Question, OSCE - Objective Structured Clinical Examination *Integrated questions from all the six specialities.							

Table 3

Salient features of discipline-specific assessment versus integrated assessment.

Module tests (Discipline-specific assessment)	End of Semester Exams (Integrated assessment)
Assessment of depth of knowledge traditional or discipline-specific format Questions are discipline-specific. Questions are exclusively prepared and vetted by subject experts from each relevant discipline Assessments are conducted and managed by the subject experts of specific disciplines. A typical example of a discipline-specific question: ● List the differences between an area-specific curette and a Universal curette.	Assessment of breadth of knowledge integrated format Questions are integrated Questions are prepared and vetted by a group of subject experts, who come together to frame a case scenario and formulate the answer schemes. Conducted and managed by the respective Year Coordinators responsible for horizontal integration of subjects taught. A typical example of an integrated question in context: <i>A patient has generalized deep periodontal pockets ≥ 6 mm in depth. He also has missing lower molars.</i> ● Formulate a treatment plan for this patient.

Lecturers also provided their positive feedbacks at the faculty monthly meetings on the sustained impetus for students to study although it meant more preparations on their part. Majority of the staff members felt that module tests provided them to frame “traditional” questions which would not fit in an integrated assessment. Some staff members opined that the academically-sound students generally seem happier that there is better ‘spread’ of the continuous assessments to keep them on their toes.

6. Discussion

The topic of imbalance between assessment of depth and breadth of knowledge exists from decades. The definition of ‘breadth’ in a clinical education scenario refers to the overall knowledge a student acquires to draw connections between disciplines for diagnosis and treatment planning for holistic and comprehensive patient care.¹⁰ On the other hand, ‘depth’ refers to the extent to which a student has focused on, amplified and explored specific areas in each discipline.⁹ To strike the optimum balance, there is a need to incorporate both discipline-based and integrated teaching, to cover ‘breadth’ and ‘depth’ in a curriculum.^{11,12} If the assumption is assessment drives learning, reforms in teaching-learning practices without reforms in assessments will be deemed futile.¹³ Metaphorically, if we expect our students to have a bird's eye view as well as a microscopic view of the field, then our assessments should measure and foster both.

The questions for the module test revolved around “must know” topics in the particular discipline. The Dean Caucus meeting (a meeting of the Deans of the 13 dental Universities in Malaysia) in a document “minimum clinical experience/competence” have listed out the “must know” and “good to know” topics for every discipline.⁶ At the monthly academic meeting it was decided to prioritise the must know topics for the module tests. An undergraduate dental student would be expected to have in depth knowledge about dental extraction rather than about facial plastic surgeries. Similarly, “must know” topics listed out in the “minimum clinical experience” document of the Dean Caucus meeting was used as a guide to identify the topics to prioritise for module tests.

Similar tensions and point-counterpoint arguments regarding assessments of breadth and depth of knowledge exists in medical, surgical, pharmacy and nursing curriculum as well.^{14,15} The model used at Faculty of Dentistry, SEGi University, Malaysia can be used to balance the depth and breadth assessments in other professions as well. Currently, the dental licensure examination in the United States is offered in two formats: integrated and traditional formats.¹⁶ Hence, exposing students to both types of the assessment formats - integrated and traditional discipline-specific assessments would be beneficial to students. This move by the faculty recognizes the wider context in which higher education operates as it would have ramifications for professional practice and future career prospects.

The model implemented at Faculty of Dentistry, SEGi University incorporates evaluation of depth in disciplines in the cognitive domain. Seemingly integrated assessment questions require more teamwork

among subject experts. However, it can be argued that case scenarios can be taken from real-life situations of the patients under treatment or from documented case reports. Such documented cases can be stored as a ‘question bank’. Certainly, through such assessments, students become familiar with cases that they may expect to treat and see in real-life situations, befitting the Malaysian OBE-based curriculum.

6.1. Limitations

Inclusion of similar pattern of discipline-based module tests for evaluation of practical tests and clinical competency tests covering psychomotor and affective domains is a challenge considering the cost and resources incurred in conducting OSCEs. The assessment structure has four summative components spread across the year, which may seem quite taxing from a student's perspective. It could be argued either way that too many assessments in a year would put undue stress on the students or could season students to all the different assessments they would face in the future. The assessment structure requires the faculty to build and vet questions throughout the year, demanding more commitment from the faculty with the increased work load. Although the staff and student perception of this method seems favourable, analysis of responses based on certain focus groups may provide directions for further research. Comparison of the performance of students in discipline-based versus integrated assessments would also be an interesting area for further research.

7. Conclusion

This commentary describes an attempt in blending integrated and discipline-specific assessments to improve students' learning experience in dentistry. The assessment format incorporates two discipline-specific summative assessments in the middle of the two semesters and two integrated summative assessments at the end of the two semesters. The underpinning educational strategy lies in the outcome-based educational curriculum to evaluate students' knowledge across the breadth and depth of medical and dental disciplines. With favourable feedbacks from students and faculty members, the move by the faculty in utilising the assessment structure successfully can be considered by other Universities and health professions.

Declaration of competing interest

There are no conflict of interests to declare.

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