Tapping Technology to give Formative Feedback for Practical Learning in Medicine

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Abstract: Effective feedback has been singularly highlighted as a significant, powerful tool for reinforcing student learning. Indeed, even highly motivated and academically geared medical students are no exception and expect regular feedback during various stages of their learning, including the basic medical/pre-clinical sciences. In this paper, we describe the use of technology enhancements and multimedia support to incorporate formative feedback on a regular basis for large student cohorts (up to 130 students) during and after practical learning such as that required in studying human anatomy.

Keywords: Feedback, formative assessment, practical learning in anatomy, basic medical sciences, educational technology

Introduction

Effective feedback (Hattie & Timperley, 2007) has been singularly highlighted as a significant and powerful tool for reinforcing student learning (Hattie, 2009). Indeed, even highly motivated and academically geared medical students are no exception and expect regular consistent feedback during various stages of their learning, including formative assessment for basic medical sciences (Ogilvie et al, 1999).

1. Developing a new practical strategy

Over five years ago, as a new medical school with a non-traditional integrated curriculum, alternative strategies were sought to teach core competencies in gross anatomy together with clinical practice applications. Anatomy, a cornerstone in medical education, requires understanding the complex three-dimensional structure and organisation of the body. Cadaveric dissection was not an option due to shortage of cadavers and cultural/religious taboos. We initially faced major challenges shifting away from a traditional dissection-based curriculum and opting for a novel learning space; a 'dry' laboratory-cum-resource centre supported with computers, audio-visual equipment and multimedia technology (Ogilvie et al, 1999). An innovative practical strategy was designed for tech savvy medical students to replace conventional dissection classes in 3-stages:

1) Guided Collaborative Learning (GCL) :This included weekly learning by Year 1 and 2 student peer groups through combination of their independent pre-class preparation and in-class group discussion of structured practical tasks, uploaded on the institution's online learning portal (Rosenberg et al, 2006). Medical students had full access to available laboratory resources and engaged hands-on with anatomy models and plastinated specimens, peer volunteers for living anatomy and interactive multimedia technology and anatomy software. Tutors - either clinically qualified or practising clinicians -facilitated this session.

2) Peer Teaching Demonstration (PTD): Weekly presentation of selected practical tasks by student groups was broadcast to the whole cohort (up to 130 students) via audio-visual technology and actively moderated by clinician tutors. Technology savvy students utilised hands-free headset microphones, real time high resolution web cameras, a visualizer and internet-enabled desktop computers with high resolution LCD projection in the Anatomy Laboratory to demonstrate models, plastinated specimens, consenting peers for surface anatomy and X-ray images.
3) Objective Structured Clinical Anatomy Review (OSCAR): The OSCAR was developed as an interactive formative assessment incorporating multimedia technology & available anatomy resources. Held at mid- or end-semester, the OSCAR served to reinforce anatomy practical skills learning and pre-exam revision. Stations were set up based on anatomy-focused questions uploaded on computers within the technology-enhanced Anatomy Laboratory. Students rotated through timed stations (Fig.1) and assessed on clinical anatomy correlation, procedural/surgical anatomy and digital radiograph interpretation. Tutor feedback/debriefing immediately followed with an interactive question and answer session. Appraisal of student knowledge and feedback on their learning inadequacies still remains a challenge as current medical education methods often lack focus on improving practical anatomy skills through reflective practice. Hence, multiple levels/ mechanisms of formative feedback were incorporated in our overall practical strategy.

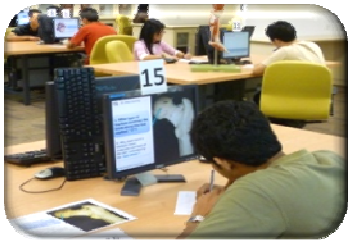

Figure 1: Station testing clinical anatomy

2. Inclusion of formative feedback in practical strategy

2.1 Peer and tutor verbal feedback during GCL and PTD

During group discussions of practical tasks, students utilise their experience in problem-based learning to readily discuss the topic at hand in a constructive manner. The clinician tutors, whilst listening in on the group discussions, are able to provide direct and immediate verbal feedback to correct student misconceptions or recognise their difficulties in practical anatomy identification skills.

Table 1: Peer group assessment of peer demonstration (n=9 groups)

Items of Student peer assessment	Mean score (max 5)
Accuracy of the content of presentation	4.1
Cohesiveness and smooth flow of presentation	3.7
Use of specimens and models	4.4
Integration of anatomy with clinical correlation	3.8
Use of audiovisual aids (microphones, visualizer, webcam, software)	4.7
Response to questions (from peers and tutors)	3.2
Overall delivery of presentation	3.8

Similarly, during student demonstration of practical tasks to their whole class during PTD, ample opportunities exist for feedback on student knowledge, skills and performance. In the earlier years, peer groups evaluated each other's performance and delivery (Table 1). Now, tutor feedback of group PTD performance is broadcast immediately and posted up weekly. At semester end, the best groups are rewarded in a simple prize-giving ceremony.

2.2 Automated feedback during GCL and PTD using Audience Response System

Recently, an audience response system (ARS) or "clickers" were introduced during practical classes (Alexander,2009) involving multiple choice or short answer questions. Topics range from basic practical identification type, second-order questions to more critical scenario/problem-based questions. Once ARS responses are locked in, quantitative and qualitative real-time feedback data are displayed and answers discussed by the tutor.

2.3 Feedback in OSCARs

Clinical anatomy learning, formatively assessed through the OSCAR, required students to respond quickly to practically-oriented tasks, mimicking the urgency of real clinical practice (Watmough, 2010). Student evaluation was highly positive for OSCARs including the feedback/ debrief sessions (Table 2). Comments included: *"Can we have OSCAR every week? Very very stimulating and increases the desire to study more about anatomy."*

Table 2: MBBS student evaluation of OSCAR and feedback learning

Percentage of MBBS students 'Strongly agree + Agree'		Year 1	Year 2
DURING OSCAR	Use of anatomy models, plastinated specimens & images stimulated my learning	99%	**94%**
	Incorporation of applied/clinical anatomy topics stimulated my learning.	98%	**96%**
	Arrangement of labs and audiovisual aids/multimedia were adequate for session	**90%**	**96%**
DURING DEBRIEF	I found the prompt feedback and discussion by tutors useful	**98%**	**98%**
	Content of the debrief session was delivered at a level appropriate to us students	**97%**	**96%**
TUTORS	Tutor(s) clarified difficult terms/concepts as required.	**97%**	**98%**
OVERALL	Current frequency of OSCAR sessions is appropriate for the semester (2/sem.)	**80%**	**74%**
	Overall, stimulation of anatomy learning through OSCAR was good.	**97%**	**94%**

Conclusion

Such a variety of feedback mechanisms (including formative feedback through practical-based OSCARs) form a relevant strategy in anatomy education and serve to benchmark students' knowledge base, promote reflection and act as a stimulus for further learning. Such feedback strategies can also be readily applied in other practical-based disciplines (e.g. nursing, allied health sciences and STEM subjects) and will inform the future design of assessment of learning.

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