Online Assessment: A catalytic mechanism for teachers to gain insight into students' prior knowledge, and scaffold learning

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Background to the study

- Teacher's understanding of prior knowledge of students?

- Teacher incentivise students to determine their gaps in knowledge

- First years: particularly problematic

→ HOW CAN TEACHERS CUSTOMISE LECTURES TO THE NEEDS OF FIRST YEAR STUDENTS?

Introduction

- Feedback is one of the top ten influences on learning

- Feedback is defined as 'information provided by an agent (e.g. teacher, peer, book, parent, or one's own experience) about aspects of one's performance' (Hattie, 2009, p.174).

  – Feedback = response to performance

  – Based on what students have done visually/verbally

  – feedback from a teacher fills a knowledge gap that has been identified by the teacher, is not a general form of instruction (Hattie & Timperley, 2007; Sadler, 1989)

Problem

- learning outcomes on course outlines indicate learning objectives of the course (not prior knowledge or threshold concepts).

- when this knowledge is made explicit, defined and clear, it becomes accessible to the students

Aim of the paper

1) to examine a way in which feedback could act as a mediator to encourage self-directed student participation, and

2) looks at how feedback could function as the teacher's tool to uncover and build on the students' prior knowledge.

Research Question

'How can feedback act as a mediator to motivate student engagement, and function as the teacher's tool to uncover and build on the students' prior knowledge?'

Framework:

- Hattie and Timperley's 'Visible Teaching and Learning Theory' describes feedback as key to student learning.
- Feedback = most powerful when it passes from the student to the teacher
- The teacher scaffolds learning to develop self-regulated learners

- Explores:
  - how feedback from online tests can enable teachers to quickly determine the relevant prior knowledge of first-years and thus enable lecturers to customize their lectures

Setting

- First year Introduction to biology course
- Degree in medical field
- Wide range of school backgrounds, language differences, socio-economic backgrounds
- First term of first year S1: 6 weeks of teaching
- More than ten years lecturing this course

Methods

- 292 first-year medical students
- three prior knowledge online tests: Cell Biology, DNA and RNA replication
- Multiple-choice questions
- Students' depth of understanding and misconceptions emerged from analysis of their responses
- Results were used to customise lectures
- At the end of the six-week lecture series students answered a questionnaire on their perception of the effectiveness of these tests and lecture-feedback sessions to their learning

Emerging Results

Table 1: Student responses on their learning approach and the usefulness of prior-knowledge tests to their learning

	Agree (%)	Neutral (%)	Disagree (%)
Studying for the semester exam requires only memorizing of course content	20,5	21,6	57,9
Completing the tests make me think	70,5	21,6	7,9
Doing the prior-knowledge tests helped me to understand course material better	62,3	22,9	14,7

	Agree (%)	Neutral (%)	Disagree (%)
Prior-knowledge tests helped me to prepare better for course material	71,2	18,8	9,9
Prior-knowledge tests were not very challenging	5,8	30,8	63
The way that I intend to study for examinations has changed since the beginning of the year	63,4	18,8	24,7

Table 2: Students' perceived value of the tutorial-type lectures

	Agree (%)	Neutral (%)	Disagree (%)
I found that the tutorial lecture sessions helped me to understand the course material	81,8	13,4	4,5
Tackling the exercises in the tutorial sessions makes me think	84,2	13	2,7
The tutorial-type lecture sessions were not challenging	18,7	44,5	36,6

Table 3: Example 1 of questions at different cognitive levels and the students'
responses

	Question presented on prior-knowledge test	Percentage (%) correct responses (n=292)
Basic recall-type question posed	Cytosine makes up 42% of the nucleotides in a sample of DNA from an organism. Approximately what percentage of the nucleotides in this sample will be thymine? a) 58% b) 42% c) 8% d) 16%	69.5

	Question presented on prior-knowledge test	Percentage (%) correct responses (n=292)
Higher-order-type question based on the threshold concept tested above for the recall-type question	In an analysis of the nucleotide composition of a molecule of DNA, which of the following combinations of base pairs will be found? a) A=C b) G+C = T+A c) A+C = G+T d) A = G and C = T	41.5

Table 4: Example 2 of questions at different cognitive levels and the students' response

	Question posed on prior-knowledge test	Percentage of students with correct responses (n=292)
Basic recall-type question posed	In DNA replication, the resulting daughter molecules contain one strand of the original parental DNA and one new strand. What is the explanation for this phenomenon? a) DNA replication is semi-conservative b) DNA replication is not conservative c) DNA replication is conservative d) RNA synthesis is conservative	91.9

Table 4: Example 2 of questions at different cognitive levels and the students' response
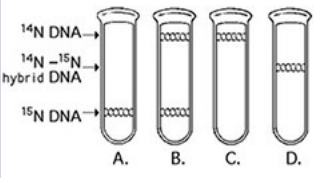
	Question posed on prior-knowledge test	Percentage with correct responses (n=292)
Higher-order-type question based on the threshold concept tested above for the recall-type question	Meselson and Stahl grew bacteria in a medium containing 'heavy' radioactive nitrogen (^{13}N) and then transferred them to a medium containing ^{14}N (non-radioactive). Which of the results in the figure would be expected after one round of DNA replication in the presence of ^{14}N?	42.3

Table 5: Grade comparison across three years for semester examinations

	2018	2014	2013
Number that wrote examinations	426	322	375
Number that passed examinations	383	254	276
% pass rate	89.9	78.9	73.6
Average	67.5	65.2	57.8

Conclusion

- when students are involved in online learning activities that enable them to self-identify gaps in their knowledge

- Teachers are key to creating opportunities for learning and providing students with alternative approaches to their studying.