Implementation of a Technology-supported Three-stage Classroom Feedback System for Promotion of Self-regulation and Assessment of Student and Teacher Performance

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Extended Abstract

Introduction
Motivation/Problem
Previous experience with teaching medium-sized and larger classes revealed insufficient classroom feedback from students on their understanding of the topics being taught and whether the learning outcomes have been achieved. As a result, there was limited potential for assessment, including self-assessment and promotion of student and teacher performance.

Hypothesis
The implementation of a regular technology-supported classroom feedback system can help to manage this problem, as this system can promote

(i) Assessment/self-assessment of student performance by gaining qualitative and quantitative information on students’ understanding/self-regulation of learning with support from internal and external feedback

(ii) Assessment/self-assessment of teacher performance by identifying/closing the gaps between the learning goals defined by the teacher and the standards met by the students.

The successful implementation of this classroom feedback system will help to continuously improve the quality of teaching and learning as well as the final teaching/learning outcome.
Tools and Methods

The clicker technology along with the TurningPoint 2008 software package was selected as a classroom feedback system. Clickers allow teachers to introduce multiple-choice questions during the lectures and to instantly collect and tabulate the answers given by the students with radio frequency remote transmitters. Though the use of clickers takes some initial investment for the teacher, the technology can be made available to all students at no cost to them. The clicker-based classroom feedback system was implemented for the life sciences module “RNA Biology and Technology” under the curriculum offered by the Faculty of Science and the Yong Loo Lin School of Medicine at the National University of Singapore. A total of 42 third year undergraduate students attended the module in Semester 1 AY2013/14.

Results

Three-stage Classroom Feedback System Provided Students with Three Different Levels of Feedback

To derive maximum benefits from the selected technology, a three-stage classroom feedback system was established. Three clicker sessions were held: the first after three lectures, the second before the mid-term exam, and the third in preparation of the final exam. The clicker sessions were structured in a way that each session consisted of two identical rounds of questioning. The first round required students’ immediate response, while the second round required students to discuss each question with their neighbours before giving the answers; this is to enhance active student engagement and to prompt students to think more deeply and critically about the module content. This set-up provided them with three different levels of feedback (Figure 1). First, the externally observable outcome of each clicker session delivered direct computerised quantitative feedback (refer to 1a or 1b of Figure 1). Second, the critical dialogue with classmates prior to submitting the answers for each second round clicker session provided students with dialogical external feedback (2). Finally, as a result of a facilitated in-class analyses and discussion of the outcomes of the first and second round of clicker sessions, the teacher was able to provide students with a class-wide qualitative external feedback (3a) from which each student could derive his/her individual feedback. The clicker-response questions were designed in a way not only to (i) gauge students’ comprehension to the module content, but also to identify (ii) areas of difficulty/confusion as well as (iii) areas of interest, which could then be addressed during subsequent lectures and tutorials. The outcome of repeated clicker sessions provided valuable information to the teacher that could be used to shape the level, speed, and content of subsequent teaching, thus indirectly providing the students with additional external feedback (3b) that was actively influenced by them.
Figure 1. Structure of a technology (clicker)-supported three-stage classroom feedback system to promote self-regulated student learning.

**Dialogical Feedback From Peers and Computerised First Round Feedback Triggered Measurable Learner Self-regulation**

Self-regulation of student learning triggered by dialogical external feedback was directly reflected in the difference between the outcomes of the respective first and second round of questioning at each clicker session (Figure 2). In all cases, the percentage of correct answers increased from the first (R1) to the second (R2) round as reflected by positive $\Delta_{R2-R1}$ values. However, the computerised first round feedback might have influenced the second round of responses as well. Notably, the difference in the percentage of positive answers between the first and second round of questioning steadily decreased from clicker sessions 1 to 3. That might indicate that the dialogical external feedback students received from their neighbours in the classroom increasingly became less relevant because they might have developed a higher level of confidence and self-esteem regardless of whether their answers were correct or wrong.

![Diagram of clicker session structure](image)

**Figure 2. Analysis of students’ feedback gained from each two rounds of three clicker sessions indicated by the percentage of correct and false answers. Sessions were conducted at different days; Rounds 1 and 2 were performed on the same day at the beginning and end of the respective lecture. $\Delta_{R2-R1}$: Increase of correct answers (%) from Round 1 to Round 2. CA: Percentage of questions correctly answered by all students.**
Classroom Feedback From Students Triggered Measurable Teacher Self-regulation

Self-regulation of the teacher’s questioning, during the clicker sessions but also during the mid-term and final exam, as a result of the students’ feedback was reflected indirectly by the qualitative and quantitative outcomes of clicker sessions 1 to 3. The percentage of correct answers steadily decreased from clicker sessions 1 to 3 each for the first and second round of questioning, indicating an increasing degree of difficulty of the questions. As a second measure, the percentage of questions that were answered correctly by all the students (CA100) significantly dropped from clicker sessions 1 to 3. Notably, the quality of correct student feedback, which was a function of the complexity of the questions and not a numerically measurable size, increased in the same manner as the quantity of correct student feedback decreased. Finally, student feedback also fostered self-regulation of the teacher’s lecturing as the design of the clicker-response questions revealed areas of difficulty/confusion as well as areas of interest, which were then addressed during subsequent lectures and tutorials.

Conclusion

The three-stage classroom feedback system provided students with three levels of feedback, thereby enabling the teacher to apply several principles of good feedback practice. The set-up of the clicker sessions and the design of the clicker-response questions, together with the feedback given, helped clarify what good performance is and supported students’ self-assessment. The class-wide discussion of results encouraged students to engage in teacher and peer dialogue and provided them with high quality feedback and opportunities to close performance gaps. Finally, this system was helpful to the teacher as the students’ feedback helped address areas of confusion and areas of interest, improving the teaching for subsequent lectures in this way.

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References
