An Overview of Classroom Response Systems (CRS) in Higher Education

A Literature Review and Summary Report From the Center for Educational Innovation
An Overview of Classroom Response Systems (CRS) in Higher Education

Introduction

A Classroom Response System (CRS) is defined as “technology that allows an instructor to present a question or problem to the class; allows student to enter their answers into some kind of device; and instantly aggregates and summarizes students’ answers for the instructor” (Mahon, 2012, p. 2). CRSs are commonly referred to by a variety of names such as: student response systems, audience response systems, personal response systems, clickers, or CRS (Martyn, 2007). The basic idea of CRS, with the teacher posing a question and the student offering an answer, is not new. Interactive questioning has been used by teachers since the era of Socrates by asking questions and raising hands. However, this type of response system does not seem to work well in a large class, because many of the students are reluctant to speak up and engage in learning activities (Caldwell, 2007). Basic call-and-response learning, in which an instructor poses questions and students respond verbally, can be ineffective in large classes since many students are reluctant to speak up in those environments.

Today, increased technological advancements such as clickers and mobile devices enable instructors to more effectively use CRS in their classroom (Lander & Stoeckel, 2012). CRS increases opportunities for even reticent or shy students to participate and many articles indicate that instructors and students prefer using CRS in their teaching and learning (Mahon, 2012). Instructors and students can benefit from the advantages of CRS, such as the anonymity—and immediacy—of response and data analytics (Carnegie Mellon University, 2007; Martyn, 2007).

On the other hand, CRS has some potential problems. The use of CRS (e.g., clickers) for interactive instruction is still fairly new to most instructors (Caldwell, 2007). Moreover, crafting quality questions and ensuring those questions are well aligned with learning objectives is key to the effective use of CRS in the classroom (Lander & Stoeckel, 2012). Another possible problem of using CRS is an unstable or disconnected internet connection (Lander & Stoeckel, 2012).

Purpose and scope of this paper

The purpose of this review is to provide an overview of CRS and its potential applications to senior administrators who are interested in introducing a CRS to their institutions. This paper presents literature reviews on various topics such as: types of classroom activities that use CRS, instructional strategies of using a CRS, best practice tips for using a CRS, and CRS software. This review includes the following sections:

- The common features of CRSs
- The instructional strategies for the use of CRS
- The best practice tips of using CRS
- The types of CRS software
Common features of CRS

There are three representative features of a CRS used in the classroom: (a) questioning, (b) immediate response and display, and (c) data analytics (Carnegie Mellon University, 2007).

- **Questioning**: Many instructors who teach in larger size classes use presentation software such as Microsoft PowerPoint or Google Slides. Consequently, most CRS software has been designed to easily integrate into common presentation software for ease of teaching and a seamless experience for the student.

- **Immediate response and display**: CRS software enables instructors to ask questions and immediately receive students’ responses. As soon as instructors receive students’ responses, the CRS software displays the results of the question. The immediacy of response and display enables students to compare their responses to others anonymously and instructors to assess the level of understanding about course content (Martyn, 2007).

- **Data analytics**: Most CRS software has the ability to export and save response data for the purpose of analysis and assessment. This analytics feature is commonly integrated with learning management systems such as Blackboard. This is especially useful for instructors teaching in large classes who struggle to appropriately assess the level of understanding and information retention of their students. The data analytics feature makes it possible to track students’ responses and perform formative evaluations during the course (Martyn, 2007).

Instructional strategies for the use of CRSs

Instructors can use a number of strategies when implementing CRS in the classroom: (a) immediate feedback, (b) classroom monitoring, (c) audience-paced instruction, (c) peer instruction, (d) equal participation, (e) game-based learning, and (f) formative assessment.

- **Immediate feedback**: Immediate feedback to students’ responses facilitates retention and creates an opportunity to correct an initially wrong choice (Turning Technologies, 2010). Instructors prepare various types of questions, such as true/false and multiple-choice questions, and during the course of the presentation pose those questions to students. They receive students’ responses and can present the results of the polling simultaneously and immediately. By participating in the polling, students are more engaged in lectures.

- **Classroom monitoring**: In a large-size class, instructors often have difficulty monitoring student attendance and participation (Lander & Stoeckel, 2012). By using the CRS software, instructors are able to monitor student participation and attendance with much less effort (Caldwell, 2007; Carnegie Mellon University, 2007). Additionally, Judson and Sawada (2002) pointed out that students had a tendency to attend class more often when the instructor used CRS.

- **Audience-paced instruction**: The ability to modify instructional strategies and teaching pace in response to learners’ comprehension is a core concept of audience-paced instruction (Carnegie Mellon University, 2007) but without a way to gauge students’ understanding, instructors will be unaware of the need to modify their instruction. One of the major purposes of using a CRS is to adjust the pace of the instructor’s teaching to students’ learning based on the level of comprehension.
Peer instruction: Once students answer questions posed to the class and check all responses, they can discuss the results of their responses and reach an agreement upon a correct answer (Mahon, 2012). This is a process of peer instruction (Carnegie Mellon University, 2007; Turning Technologies, 2010). CRS can be also used as an effective tool for peer instruction by enabling instructors to collect data on the level of students’ comprehension on topics and to adjust their instructional strategies immediately.

Equal participation: Often, more outgoing students have a tendency to dominate student/instructor interactions in both small- and large-size classes, which in turn cause uneven participation in learning activities (Lander & Stoeckel, 2012). CRS resolves this issue of uneven participation in the class by giving equal opportunities for all students to anonymously participate in answering questions. Using a CRS, instructors can give all students an equal opportunity to engage in participation activities in class regardless of class size.

Game-based learning: Most CRSs support the principles of game-based learning such as competitive practices at the individual and team levels (Martyn, 2007). For instance, instructors can form two separate teams of students and have the two teams compete on a set of quizzes. This game-based approach to lectures increases student motivation and promotes more active engagement.

Formative assessment: CRS can be a useful tool for formative assessment by offering the instructor the ability to check the level of student knowledge and understanding of concepts in real-time. Coupled with audience-paced instruction and peer instruction strategies, CRS as a formative assessment tool can be used to modify teaching pace and strategies.

Best practice tips for using CRS

This section introduces a variety of tips for best practices in using CRS in the classroom. Instructors who are not familiar with CRS can begin with the following tips for effectively using CRS in their classes (Caldwell, 2007). The following tips are adapted from several articles (e.g., Caldwell, 2007; Martyn, 2007; Missouri State University, 2015).

- Planning
  - Instructors should plan to spend extra effort and time to ensure they develop quality questions.
  - Before incorporating a CRS in a teaching scenario, it is helpful to observe how other instructors are using CRS in their classes.
  - Be prepared when students forget to bring clickers, clickers run out and/or are broken.
  - Establish a grading plan in the beginning and align it with the use of CRS.
  - Insert the principles of game-based learning so students are more engaged.
  - If your class uses the flipped classroom model, prepare some questions in the beginning of class to gauge if the students have read and understood the learning they’ve done outside of class.
  - Have discussion time after asking an initial question.
  - Test the CRS in the classroom before you use it in an actual class.
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- **Attendance**
  - Use CRS on a daily basis and align the use of CRS with grades if you want to increase student attendance.
  - Use CRS is especially useful for increasing attendance and accountability in introductory courses for freshmen.
  - Use point values for questions in order to award attendance and participation.

- **Communication**
  - Explain the reason why instructors use CRS in the classroom and what you expect from students’ experiences of using CRS in the beginning of the semester and on the syllabus.
  - Use an “ice breaker” to give the students a chance to practice using the CRS.
  - Provide sufficient time for students to discuss answers to each question. General guidelines are as below:
    - Fewer than 30 students in a class: 15 – 20 seconds per question
    - 30 to 100 students in a class: 30 seconds per question
    - More than 100 students in a class: 1 minute per question
  - Be willing to adjust your original lecture plan based on the formative assessments the CRS provides.

- **Questioning**
  - Do not develop overly complex questions.
  - Use questions only for core concepts in the class.
  - Keep the number of answer options to five.

**Types of CRS software**

There are many vendors that provide CRSs for higher education institutions. Table 1 shows the comparisons of CRS vendors based on the following features: (a) voting technology, (b) student license cost, (c) presentation tool, (d) asynchronous content access, (e) student performance analytics, (f) advanced question types, (g) student to student interaction, (h) integration with LMS, (i) vendor faculty support, (j) vendor student support, and (k) game interaction.
<table>
<thead>
<tr>
<th>Compared Item</th>
<th>Top Hat</th>
<th>Echo360 Lecture Tools</th>
<th>OMBEA</th>
<th>Poll Everywhere</th>
<th>Via Response</th>
<th>Turning Technologies</th>
<th>Infuse Learning</th>
<th>Socrative</th>
<th>i&gt;Clicker</th>
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<td>Voting Technology</td>
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<td>Clickers/Web/App</td>
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<tr>
<td>Student License Cost</td>
<td>$20 Term or $38-5yr</td>
<td>$25yr/ $15 Term</td>
<td>$18-yr for web, $40 per clicker</td>
<td>$14yr. $9 Term</td>
<td>$20 6 months</td>
<td>$15yr-Web/App Clicker Device $40-53</td>
<td>Free</td>
<td>Free</td>
<td>Lifetime clickers are $30.99/$41.99 (free 6-month access to the mobile solution included)</td>
<td>First 14 days are free. $9.99/Term $15.99/1yr $21.99/2yr $31.99/4yr</td>
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<td>√</td>
<td>Present with anything (slides, video, website, etc.). No import of content required.</td>
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<td>Integration with LMS</td>
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**REEF Analytics** - Insight to usage across your campus, department, and classrooms

**Advanced Question Types** - Most popular features used by instructors included

**Student to Student Interaction** - REEF Quizzing (beta) - Incorporate group activities and collaborative learning

**Integration with LMS** - Seamlessly integrate with all major LMS platforms, including Blackboard Learn, Canvas, Desire2Learn, Moodle, and Sakai. LTI available. Generate Excel reports of aggregate and individual response data.
| Vendor | Faculty Support | √ | Extensive Online Doc’s, and Question Form | √ | √ | Institution has Acct Manger | √ | √ | X | √ | Online User Guide | √ | Comprehensive online materials and dedicated support | √ | Comprehensive online materials and dedicated support |
| Vendor | Student Support | √ | Extensive Online Doc’s, and Question Form | √ | √ | Comprehensive Online Guidebook | √ | Online Docs | X | X | √ | Online support portal with FAQs, videos, user guides, etc. | √ | Online support portal with FAQs, videos, user guides, etc. |
| Game Interaction | √ | Tournament with leaderboard | X | √ | Competitions with leaderboards | √ | Tournament Mode | X | X | X | √ | One Preset Game | X | X |

Source: An excerpt and summary from the comparisons of student response systems (Social Compare, 2016)
Conclusions

Higher education institutions adopt CRSs to promote student engagement in learning activities and enhance interactive instruction, especially in large classes. This paper gives an overview of CRSs, including their features, instructional strategies instructors can use with CRSs, best practice tips for using CRSs, and comparisons of different CRS software. Through the review of the literature, we can see the potential value of CRS in useful questioning, immediate response and display, and data analytics features. In particular, CRS can be a very effective tool to increase student involvement in learning activities in large size classes. The introduction of a CRS to a large lecture class benefits students and faculty and meets their need for technology-integrated instruction.
References


