INTRODUCTION

Student response systems (also known more informally as “clickers”) have been used in higher education for over a decade, with promising results in many disciplines. Research has demonstrated that such systems increase both student engagement and learning, while leveling the playing field by inviting participation by all members of a class. The findings have been consistent across levels (introductory, advanced, undergraduate, and graduate courses), class sizes, and academic disciplines (Sevian & Robinson, 2011; Kay & LeSage, 2009).

However, student response systems impose costs on institutions where they are adopted. Faculty training is needed to ensure that the systems are used effectively, and course revisions must be implemented to integrate the devices. Dedicated devices have a cost, which is borne either directly by the students or the institution. In addition, Information Technology (IT) departments incur costs in responding to faculty and student issues. While the initial introduction of student response systems involved dedicated devices, online alternatives have been available for several years, enabling faculty to adopt a student response system that uses devices such as cell phones, tablets and laptops.

This paper presents an instructional technology initiative at a small private university, where three faculty members in different disciplines piloted “bring your own device”
Software-Based Student Response Systems: An Interdisciplinary Initiative

Carol M. Fischer, Michael S. Hoffman, Nancy C. Casey, & Maureen P. Cox

This study was conducted during the fall 2012 semester at a small, private northeastern liberal arts university. Hardware-based student response systems had been used at this institution for a number of years. The university's IT staff partnered with three instructors to determine the instructors' perceptions of the efficacy of software-based student response systems.

Several software-based clicker systems were considered... The participants met several times during the semester to share their experiences. Since the instructors utilized the technology in different ways, these meetings allowed them to generate new pedagogical ideas for how to use the clicker systems in class. IT provided assistance on any technical issues the instructors were experiencing. At the end of the semester the participants co-hosted a university forum to share their experience with their peers.

In the following sections the instructors each share their qualitative impressions of the software systems. Each instructor paid particular attention to the extent to which the systems were supported by hardware being brought into the classroom by their students; was easy to use; and any technical issues that were encountered. Each instructor assessed the general sentiment of their students towards these systems.

Student Response Systems, Mathematics

The mathematics professor in the initiative used Socrative for a variety of purposes. 1. Most students were freshmen, but there were a significant number of upperclassmen, mainly sophomores. During class time, the professor used an assortment of methods (incorporating questions and class discussion), group activities, graded assignments, and exams. The professor had no previous experience with student response systems.

METHODOLOGY

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Several software-based clicker systems were considered... The participants met prior to the start of the semester to discuss how such systems could be used to support instruction and to preview a variety of different software-based clicker systems. The systems selected for this study were Socrative and Top Hat Monocle (now known as Top Hat). Socrative was chosen for its ease of use and because there was no cost. Top Hat was chosen for its robust feature set as well as ability to support cell phone text responses.

The participating instructors all had over twenty years of teaching experience and hailed from three different disciplines: mathematics, business, and economics. Each instructor utilized software-based clicker systems in face-to-face undergraduate courses during the semester; all three used Socrative, two also used Top Hat. Student access to appropriate devices was not an issue in any of their classes.

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LITERATURE REVIEW

BYOD is becoming increasingly popular in support of student engagement. The importance of student engagement, and the publication of Student Success in College: Creating Conditions that Matter (Kuh et al., 2005) brought the language and elements of student engagement to the forefront of discussions throughout higher education. Research supports the assertion that students report higher levels of engagement when faculty members use active and collaborative learning (Umbach & Wawrzynski, 2005). The adoption of cooperative learning practices, the movement from "sage on the stage" to "guide on the side," and the trend toward flipped classrooms have all grown from a desire to increase student engagement and improve learning outcomes. The use of student response systems represents one technique that has gained traction as faculty members seek to implement active learning practices to engage students and support learning. The first commercial active learning solutions were hardware-based systems that required the purchase of hand-held units that were used to input responses to questions posed by the instructor.

As such systems grew in popularity, developers created alternative software-based systems, which make use of the students' own devices. Such systems are web-based and typically require either a cell phone with texting capabilities or a laptop computer and internet access. Regardless of the type of system adopted, the purpose of using a student response system is to enhance student engagement and improve learning. Thus, a key question is the extent to which these systems are effective. Several literature reviews have summarized studies from different disciplines and concluded that student response systems are well received by students, increase engagement and improve learning outcomes (Kay & Leahey, 2013). However, the literature on efficacy of student response systems does not distinguish among different types of systems (hardware-based vs. software-based). Since both types of systems provide essentially the same functionality, the choice appears to be a matter of preference and budgetary constraints.

The Bring Your Own Device (BYOD) movement, began as a strategy to encourage employees to use personal electronic devices in the workplace (Burns-Sardone, 2014). Employee laptops, tablet computers and smartphones are examples of the types of technologies typically seen in a BYOD program (Burns-Sardone, 2014). Encouraging employees to bring and use their own devices provides organizations with several potential advantages including a reduction in technology acquisition expenses as well as increased employee comfort with technology (Afrein, 2014).

BYOD is becoming increasingly popular in support of students at educational institutions (Burns-Sardone, 2014; DiFilipo & Kondrach, 2012). The BYOD trend has even spread to college students as well (Afrein, 2014), suggesting that the expectation among students for support for BYOD from higher education institutions may continue to grow. In a recent study of U.S. undergraduate students, Dahlstrom et al. (2013) found that 90% of students own a laptop computer and 39% own a tablet computer. The prevalence of easy access to the Internet on college campuses has resulted in many students using their laptops for daily tasks, including as an instrument in support of class attendance. The use of mobile devices in and out of class has become an important part of the undergraduate experience. In a survey of U.S. undergraduate students, Dahlstrom et al. (2013) found that... tablets grew the most in terms of academic use compared with other devices... (p. 27).

The rate of smartphone ownership among U.S. undergraduate students continues to increase (Dahlstrom et al., 2013). In a survey of U.S. undergraduate students, Dahlstrom et al. (2013) found that 76% reported owning a smartphone in 2013 compared with 62% in 2012. Similarly, in a survey of 403 undergraduate students, Emanuel (2013) found 85% reported owning a smartphone. At the institution where this initiative took place students were surveyed regarding device ownership during the 2014 spring semester. Among the survey respondents, 99% reported having a smartphone, with 96% of classroom computing device owners reporting their primary computing device as a laptop computer. More than 98% reported that they owned a smartphone and 35% of the respondents owned a tablet.

As college students are increasingly likely to own one or more mobile technology devices, college instructors may consider asking students to use their own devices as classroom response systems (Haintz et al., 2014). Leveraging students' personal devices as response system devices offers several advantages including improved student engagement, cost savings, and increased support for the spontaneous use of response system technology (Afrein, 2014; Good, 2013; Haintz et al., 2014). Fortunately, students have been found to be both ready and willing to use their smartphones in this capacity (Dahlstrom et al., 2013).

Traditional classroom response systems are hardware devices that must be configured for each individual classroom and distributed to students prior to use (Lee et al., 2013). This requires considerable planning in order to utilize the devices in the classroom. Additionally, the hardware-based response systems are limited by the number of available "clickers" (Lee et al., 2013). Software-based response systems, by contrast, do not require a student to bring a separate response system device to class (Stoner, 2012). Rather, students are able to use their own devices to interact with a software-based response system. In addition to enabling a greater level of spontaneity in use of the response system, this approach does not rely on either students remembering to bring a hardware-based "clicker" to class or an instructor handing them out prior to class.

Finally, hardware-based student response systems require installation of the handheld "clickers" devices (Good et al., 2013; Lee et al., 2013). Using a software-based response system eliminates the cost of the specialized devices. Institutions may elect to move to a software-based system as part of a cost savings initiative (Afrein, 2014).

METHODOLOGY

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Through Socrative, the professor created and saved mul-
tiple choice or short answer quizzes. The quizzes were used
to spot check knowledge of definitions and concepts
previously covered. Eight quizzes were given over the
course of the semester. The instructor allowed collabora-
tion on the quizzes in case students needed to share de-
vices, although some students passed devices on so that
they could work independently. However, this did not cause
a problem with the activity lasting too long, but whether
to insist that each student work alone, and therefore likely
needing devices to be passed on, or allowing collaboration
is something to consider when planning. The quizzes were
counted toward the class participation segment of the
course grade and the scores, which were emailed to the in-
structor as an Excel spreadsheet, were used as a formative
assessment.

A strength of Socrative is that it can be learned easily and
quickly through exploring the various options in the pro-
gram, with no guidance other than the help that the pro-
gram provides. The professor had considered using Top
Hat in addition to Socrative to compare the two systems,
but it quickly became apparent that Top Hat was not as
intuitive, flexible, and easy for both the instructor and
students. Both systems were used in similar ways. Both al-
cowed students to access. Since it allowed for open-ended
responses, Socrative was ideal for group-based quizzes, in
contrast to the more restricted form of assessment pro-
vided by Turning Point. For this initiative, Top Hat and
Socrative were equally easy for students to use and access.
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The positive responses that accompanied a “take out your
cell phones” policy in this course were not always posi-
tive. “Google moments” during instruction and discus-
sions seemed to be more frequent, especially in classes
where the professor had a high percentage of students
using their cell phones during class and assignments require
course in the classroom for texting, surfing the web, and other non-instructional purposes. Rather than
ignore reality, this instructor has turned the use of
cell phones toward learning, having students use them for
“Google moments” during instruction and discussions.

This professor used student response systems in three
junior-level classes in Education, taught as a three-course
block, so the same dozen students were in all three classes.
The class content is a combination of educational theory
and pedagogy and therefore, it is incumbent upon the in-
tstructor to model the use of a variety of teaching strate-
gies, and it is especially important that she demonstrate
flexibility when a tool does not work or there is a technical
outage. Some form of technology is used in almost every
class and assignments require considerable use of technol-
gy.

Prior to this project, this instructor had used a variety of
student response systems including Socrative and Poll
EveryWhere (another software-only system) and Turn-
ing Point. For this initiative, Top Hat and Socrative were
used. Both systems were used in similar ways. Both al-
low a variety of clicker-based activities. Socrative offers the
tility afforded by the software-based systems. Not only was
she freed from the task of carrying devices to class, there was a time
savings from no longer distributing and collecting the de-
vices at the beginning and end of class, and she was able
to spontaneously ask clicker questions to check student
understanding. The instructor has continued to use both
Turning Point and Socrative in the following years, and has
mixed the two systems in all of the courses, but with
Socrative being more centrally part of the class. As the percentage of students who own smart phones
and/or tablets has increased, this instructor has moved
towards greater reliance on the software-based system,Turn-
ing Point. In addition to increasing the use of student
response systems in class, this initiative also helped the in-
tstructor to think more deeply about student learning and
the appropriate use of technology to foster engagement
with the content. The “wow factor” is short-lived, but the
deep thinking required when students are actively en-
gaged during class contributes toward improved learning.

Teaching Students Who Will Be Teachers

“Good Morning, let’s get started. Take out your phones, please.”
Locks of confusion greet that class opening. The instructor
can “hear” them thinking “she hates it when we have
our phones out. What’s going on?” But they dutifully
take out their phones and we get started.

The education professor involved in this initiative has
an academic background in curriculum and instruction with
an emphasis in educational computing. She is a regular
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to be a positive regular addition to her toolkit of instructional strategies. Although both systems were reasonably accessible, this instructor found that Socrative was easier and faster both for developing activities and for students to access. Socrative is the system that has continued to be used.

Varying instructional strategies is important for student learning. Engaging students during class can only enhance that learning. And turning the ever-present cell phone into a tool for classroom engagement can’t hurt.

Discussion and Conclusions

Although the three instructors who participated in this initiative come from different disciplines and have different teaching styles, each found ways to use software-based student response systems. This initiative was not designed to measure the impact of response systems on student learning, but it was clear that the students responded positively to these interactive activities: all three instructors saw an increase in student engagement. All three instructors preferred Socrative for its ease of use, flexibility, and powerful reporting tools. Socrative makes sharing devices easy by allowing students to enter more than one name as they begin an activity, allowing collaboration. Another Socrative feature is that quizzes can be restarted for another student without having to exit and re-enter the program. Therefore a device can be passed from one student to another, allowing all students to complete the activity independently. Finally, the adoption of this system frees the university (or students) from the need to purchase dedicated clicker devices, and enables instructors to insert poll questions spontaneously, if desired. Importantly, all three instructors have continued to use Socrative, an indication that this technology is worthwhile addition to an instructor’s teaching strategies. Based on our discussions with one another, we offered the following suggestions to those who plan to adopt this technology.

Having students pair or team up for these activities may seem counterintuitive. They are called “student” response systems after all. While individual response is often preferred, grouping students has advantages. First, it solves the “my phone isn’t working” problem. More importantly, it allows for variety in the types of questions and activities that can be conducted using the student response system. Because you can ask a question where students can enter their names, you can still know whose work is being recorded. As reported here, both approaches can work.

Each of the cases reported in this paper used both graded and ungraded activities and both have a place. Quick “check-ins” during class can help the flow for a professor who is willing to take alternative paths through a class. Beginning-of-class Q & A can encourage student preparation. Using response systems for graded quizzes or tests – especially short ones – can be especially useful. Because they are scored by the software, there is no additional grading burden; further, students get more feedback (about their own performance and how it compares to others in the class) and faculty get more information about how well students are mastering the course material. This is a distinct advantage of this instructional approach.

Using prepared activities and quizzes is probably the most common way student response systems are used, and that may be the most time-efficient use both in terms of actual class time and grading. However, the anonymous polling feature of Socrative adds the ability to make class time more interactive while providing instructors with feedback at critical points during a lecture or other class activity. Once both instructors and students are comfortable with the technology, spontaneous use becomes quite quick.

On this campus, the rapid increase in the number of students with smartphones and tablets has made the use of software-based response systems the way to go. Careful consideration must be taken before using this approach for required or graded activities. If an instructor uses the system for individually graded activities, it is advisable to have extra devices available for students without their own. Battery power and malfunctions must also be considered in any high-stakes use (which even a graded quiz can be).

Of course the most important consideration is student learning. Active engagement during class is one way to keep students on task. The students involved in this pilot responded positively to the introduction of student response systems. Rather than thinking of student response systems as introducing a new technology into the classroom, think of it as gaining more time on task.

REFERENCES


Smith-Stoner, M. (2012). Class is about to start: Please turn on your cell phones: 10 uses for cell phones in nursing education. Teaching and Learning in Nursing, 7, 42-46.

