Students vote: A comparative study of student perceptions of three popular web-based
student response systems

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Student response systems (SRS) provide an excellent method for engaging students in the seated classroom. Most SRS without proprietary distinction provide a variety of open ended questions that students can answer on mobile devices or laptop computers. Live results appear on the screen in an anonymous fashion. Accordingly, student response systems, or clickers, supply multiple benefits to students as cited in the literature. For instance, many authors state increased engagement (Kaleta & Joosten, 2007; Kay & LeSage, 2009; Nagy-Shadman & Des Rocher, 2008; Stowell & Nelson, 2007), the ability to identify misconceptions (Draper & Brown, 2004; Kay & LeSage, 2009; Murphy, 2008), immediacy of results (Draper & Brown, 2004; Kaleta & Joosten, 2007; Trees & Jackson, 2007), and student anonymity (Kay & LeSage, 2009; Murphy, 2008; Stowell & Nelson, 2007; Trees & Jackson, 2007) as potential advantages to using SRS. Most importantly, the SRS allow professors to gauge student understanding and adapt classroom lectures accordingly. This is referred to as contingent teaching by Kennedy and Cutts (2005) or on-the-fly teaching by Bruff (2007). To reap the benefits of SRS, professors and universities must make choices concerning which system is best for them but there is currently a lack of published research concerning student perceptions of specific student response systems. This study addresses three distinct SRS: TopHat, Socrative, and Learning Catalytics.

With respect to the proprietary SRS of this study, only a few specific studies cite quantitative effects. In example, Neilson et al. (2016) reported that 57% of the students indicated that using TopHat was of some value to them, while 46% of the 180 students reported that the app helped them to stay focused. They summarized that TopHat provided students with a "collaborative learning experience and allowed them to provide quick instructor feedback" (p. 118). Likewise, Mendez-Coca and Slisko (2013) claimed that by using Socrative in class, professors can make real-time assessment of the students learning and motivate students through increased opportunities for active learning. Their research found that 70% of the students agreed that using Socrative increased their involvement in class and 91% claimed that it made them realize what they knew. They further asserted that the app facilitated the argumentation and the exchange of opinions between students (94% agreed or strongly agreed with the statement) and helped students to better understand course concepts (54% agreed or strongly agreed with the statement). Finally, Northwestern University found favorable results in the use of the TopHat

app by Psychology Professors Gorvine and Smith. Their research found means of 3.7 or above for questions such as "helped me to stay focused" and "provided a break from the class" (Taylor, 2016, p. 118). Despite the small amount of scholarly literature concerning each of the proprietary SRS, more detail is needed for the context of the current study.

The first SRS of this research is the TopHat application. The website focuses attention on the app's ability to take attendance and do in class polling, games and quizzes. It allows for multiple choice, short word and numeric answers, word cloud, click on target, matching, and sort/rank questions. One unique facet of this particular SRS is its ability to provide the technology for in-class lecture note sharing within its program on the smartphone screen. It is specifically made for large group lectures, including cloud-based access. It is compatible with most learning management systems and allows for the downloading of results. TopHat is also both ADA and FERPA compliant.

The second app of the study is called Socrative. Its on-the-fly questions are multiple-choice, true false, or short answer varieties. However, it also provides a space race component which let students compete against one another or within groups on pre-formed quizzes. Additionally, an exit ticket option allows students to paraphrase what they have learned in any particular class session. Results of all questions may be saved into an Excel spreadsheet and immediately emailed or downloaded directly to a Google Drive account. Unfortunately, the free version of Socrative is limited to 50 students per session, but the paid version of Socrative pro allows more accounts per class.

The third app included in the study is called Learning Catalytics. Its question format is much more robust than the other two apps included in the study: composite sketch, confidence, data collection, direction, expression, highlighting, image upload, long answer, many choices, matching, multiple-choice, numerical, priority, ranking, region, short answer, sketch, word cloud, and slide. Many of these questions are conceptual in nature. They may be chosen from a huge global repository of questions, self developed, or given to students on-the-fly. Learning Catalytics is a free service to Pearson My Lab Plus products, although it is also available in a paid standalone version. Like the other apps, it records student answers and provides anonymous feedback in real time. The unique feature of Learning Catalytics, however, is that it can group students based on the likeness or difference in the answers of individuals to best facilitate classroom discussion.

The major purpose of the study was to determine student perceptions of the 3 specific aforementioned student response systems and thereby enhance practitioner knowledge to improve classroom practice with technology-related formative assessment. There were three research questions. First, is there a difference in the degree of ease-of-use for groups using Socrative, learning Catalytics, and TopHat SRS? The second asked is there a difference in the level of perceived usefulness of classroom engagement for groups using Socrative, Learning Catalytics, and TopHat SRS? The third question asked is there is a difference in the Likert scale

ratings for groups using Socrative, learning Catalytics, and TopHat with respect to the level of user acceptance of the SRS?

Methodology

This study used a mixed methods approach to study 4 sections of statistics students (n= 84) during a pilot round of the SRS in the spring semester of 2017. Twenty students used the TopHat application in their class, two sections used Learning Catalytics with a total of 44 students included, and one class of 20 students used Socrative. Each class used their respective SRS for the entire semester. On the quantitative side, Likert scale ratings were used to measure responses to the three research questions. For instance, to measure ease of use in the classroom, a 5= great, 4= good, three equals neutral, 2= bad, and 1=terrible. Similarly, to measure usefulness of the software/app, a rating of 5 was very helpful, 4 was somewhat helpful, 3 was OK, 2 was burdensome, and 1 was very burdensome. Finally, user acceptance and potential satisfaction was demonstrated with 5= like it a lot, 4= like it some, 3=neutral, 2= dislike it some, and 1=did not like it at all. Qualitative follow-up questions were also answered to better parse out student perceptions. These latter survey questions were analyzed with a phenomenological approach for thematic elements.

Results

The results provided descriptive statistics for the average responses to research questions. In the ease of use category, the TopHat application earned a mean score of 4.25 and a standard deviation of .44. The Socrative app scored a mean of 4.5 and standard deviation of .51. The Learning Catalytics app demonstrated a mean of 3.62 and standard deviation of .72. The results of the usefulness question for TopHat, Socrative, and Learning Catalytics showed respective means of 4.3, 4.6, and 3.8. and standard deviations of .8, .6, and .88. The user acceptance question showed TopHat with a mean of 4.35, Socrative with a mean of 3.82, and Learning Catalytics with a mean of 4.6. The respective standard deviations for acceptance were .59, .60 and .89. At the inferential level, results were also given for each of the three research questions.

The results for the first research question dealing with ease of use showed $F(2,82) = 16.52$, $p< .000$. The Tukey's post-hoc test showed that the means for Socrative and TopHat were equal in the population, but both were significantly above the mean for Learning Catalytics. With regard to the second question concerning usefulness of the apps, the results showed $F(2,82) = 6.71$, $p< .01$. Likewise, the post-hoc test resulted in statistically significant results in Socrative mean higher than the average for TopHat, while the TopHat mean was greater than the mean for Learning Catalytics. Finally, the third question for user acceptance results demonstrated another significant effect. The result was $F(2,82) = 8.25$, $p< .001$. The post-hoc test showed no significant differences between the means for Socrative and TopHat, although both of the former apps had statistically significantly higher means than that of Learning Catalytics.

From the quantitative perspective, themes are easily discern. For instance, five of the TopHat students felt that it worked well, was easy to use, and was involving. However, five students also felt that some things could not be entered correctly based on the limitations of the app. For example, some student quotes included "It changed up the lecture and involved the class" and "It's simple and if your answer is wrong no one will know it's you." One student commented that "It gets everyone in the class and their answers are secret." Another student stated, "I used clickers in high school but I like TopHat much better."

The results of the Socrative comments were similar in nature. Five students felt that they could get involved in the class and that the app worked well. Ten students said it was simple and easy to use and that they liked that they could compare answers to what other students said. Six students like the ease of response with instantaneous results. Their respective quotes were equally positive when compared to TopHat. They stated "It is easy to use with no technical errors" "It worked every time and ran fast" and "I like the ability to have multiple types of questions like short answer multiple-choice as it keeps the students engaged." One student stated, "I like the program, it makes it easier to pay attention in class" and another said "I felt more comfortable answering because it didn't matter if I was right or wrong."

Students in the Learning Catalytics groups had much more negative comments. Sixteen students stated that it was a hassle to get into and 13 specifically commented that logging in took up too much class time and did not always work. Representative quotes included "It's a hassle to get into and takes up the majority of the time" while another said "It wasn't too bad but sometimes I was confused what to put or what was being asked." The final student quote was informative as well as helpful: "It is OK to keep using but I would still try to find another one that is a little more simple to figure out."

Conclusion and Discussion

Students appear to engage at deeper levels in the classroom, regardless of SRS. The positive comments were not SRS specific. They feel generally satisfied with the use of SRS for student engagement, love the anonymity of the results, and comment positively regardless of SRS. However, only the Learning Catalytics SRS portrayed the negative themes of log-in time, ineffectiveness, and unclear questions. Additionally, TopHat allowed for on-phone presentation which may increase phone use and create additional distraction as notifcations from other apps come in view during the class sessions (Scornavacca & Marshall, 2007; Terrion & Aceti, 2012). Quantitatively, Socrative and TopHat were equal in two of the three research question areas, although Socrative earned the soul top honors in the area of integration. Davis (1989) stated that "All else being equal, the easier the system is to interact with, the less effort needed operate it, the more effort one can allocate two other activities" (p. 334). Therefore, with all data considered from both the qualitative and quantitative perspectives of students, the Socrative app for student response systems is highly recommended.

Limitations

        Limitations of the current study are that the same professor, content, and assessment were used. Though this provided conformity, it could also be seen as a limiting factor in addition to only using three proprietary SRS for the comparison. Each SRS held its own pros and cons which may or may not be applicable to other university needs. Moreover, the negative comments of the Learning Catalytics app log-ins could be a factor the learning management system used by the university in the study. Finally, the university involved in the study focuses on small classes which are not necessarily applicable to larger universities with extensive lecture halls.

References

Bruff, D. (2007) Clickers: A classroom innovation. *National Education Association, 25(1*), 5-8.

Davis, F.D. (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319-340.

Draper, S.W., & Brown, M.I. (2004). Increasing interactivity in lectures using an electronic voting system. *Journal of Computer Assisted Learning, 20*, 81-94.

Kaleta, R., & Joosten, T. (2007) Student Response systems: A University of Wisconsin system study of clickers. *Educause Center for Applied Research 2007, 10*, 1 - 12.

Kay, R., & LeSage, A. (2009) Examining the benefits and challenges of using audience response systems: A review of the literature. *Computers in Education, 53*, 819-827.

Kennedy, G. E., & Cutts, Q. I. (2005). The association between students' use of an electronic voting system and their learning outcomes. *Journal of Computer Assisted Learning*, *21*(4), 260-268.

Mendez-Coca, D. & Slisko, J. (2013). Using Socrative and Smartphones for the support of collaborative learning. *European Journal of Physics Education*, *4(2*), 17-24.

Murphy, T. (2008) Proceedings of the 36th annual ACM SIGUCCS fall conference: moving mountains, blazing trails.

Nagy-Shadman, E., & Des Rocher, C. (2008) Student Response technology: empirically grounded or just a gimmick? *International Journal of Science Education, 30(*15), 2023-2066.

Neilson, M., Mafi, G., Pfieffer, K., VanOverbecke, D., & Ramanathan, R. (2016) Students' perceptions regarding the use of tophat as an interactive tool in meat science class [Abstract]. Meat Science, 117-118. doi:10.1016/j.meatsci.2015.08.043.

Scornavacca, E., & Marshall, S. (2007) TXT-2_LRN: improving students' learning experience in the classroom through interactive SMS. *Proceedings of the 40th Hawaii International Conference on System Sciences,* 1-8.

Stowell, J., & Nelson, J. (2007) Benefits of electronic audience response systems on student participation, learning, and emotion. *Teaching of Psychology, 34(*4), 253-258.

Taylor, M (2016) Beyond clickers: Student response systems evolve, Retrieved from: http://web.madstudio.northwestern.edu/beyond-clickers-student-response-systems-evolve/

Terrion, J. & Aceti, V. (2012) Perceptions of the effects of clicker technology on student learning and engagement: A study of freshmen chemistry students. *Research in Learning Technology, 20*, 1-8.

Trees, A. & Jackson, M. (2007) The learning environment in clicker classrooms: Student processes of learning and involvement in large university-level courses using student response systems. *Learning Media and Technology, 32(*1), 21-40.