Using Socrative Software for instant formative feedback in physics courses

Abstract

The aim of this study was to understand how students' attitudes were connected to the web based software Socrative. The study was conducted with 50 students taking first year physics courses in a university. The survey dimensions were based on four previous research works and the survey instrument was extended to better reflect the current study needs. Quantitative results showed that there was no difference between attitudes of male and female students. Moreover results indicated that students in the civil engineering major had significantly more positive attitudes than molecular biology and genetic major students. For the results of the qualitative question students generally mentioned the practical use, time saving, immediate feedback and enabling many question types as the advantages of Socrative. Based on these results, it can be noted that Socrative serves an important role in student engagement and attitudes toward physics.

Keywords: Student response system, Socrative software, formative feedback, students' attitude

Introduction

Student response system

Exclusive importance is given to educational technologies and mobile learning as a new tendency of highly growth-based interconnection of devices by the dramatic development in information and communication technologies. Mobile learning is a kind of e-learning that uses the Internet and computer technology, and provides learning over cellular portable devices like tablets and smartphones (Georgiev, Georgieva, &

Smrikarov, 2004). The presentation of new technologies in classrooms has become indispensable and leading tools in educational institutions. Nowadays, almost all institutions are providing projectors, smart boards and wireless Internet connection. There are also some institutions which provide laptops or tablet PCs both for their instructors and students. Technological devices and computers which are used in classrooms are increasing teaching and learning skills (Windschitl, 2009; Luu & Freeman, 2011). Computer technologies provide educational institutions with an extraordinary chance to increase learners' motivation and improve learning outcomes (Roblyer & Wiencke, 2003). Using smart phones in class encourage to improve learners' outcomes (Duncan et al., 2012). Smart phones are very useful, learners never let them go; they are generally turned on and students use them anywhere and anytime (Kolb, 2011). By using smart phones it is easier for instructors to observe learners' performance in real time (Manuguerra & Petocz, 2011). If all the technologies mentioned above are used for academic purposes, the benefits are countless. They will be beneficial tools for learners, instructors, and the institutions themselves.

Using technology for student response system (SRS) has been widely researched in the last decade and its practical applications effect learners learning process and becoming popular among instructors. Studies indicate that SRS increase student engagement and involvement in the classroom (Heaslip, Donovan, & Cullen, 2014). Also, SRS has proven to be an effective tool in helping students to learn and in helping

teachers instruct more effectively (Aljaloud et al., 2015). Being a handy application SRS, “allows an instructor to present a question or problem to the class; allows students to enter their answers into some kind of device; and instantly aggregates and summarizes students’ answers for the instructor” (Beatty, 2004; English, 2003; Burnstein & Lederman, 2003). SRS is used by Beatty (2004) in the education field by a large number of instructors and it appears the instructors considered the author’s following recommendations. “Student response system can be used to insert occasional audience questions into an otherwise traditional lecture, to quiz students for comprehension, or to keep them awake. These uses are a waste of the system’s potential. To truly realize the benefits of student response system, an instructor must rethink her entire instructional model and the role class time plays within it and make student response system use an integral part of an organic whole” (p. 3-4). As Dufresne et al. (2000) stated, this practice “informs teachers about what students think; it informs students what their classmates think; it informs individuals what they themselves think” (p. 11). In a recent review work, (Aljaloudet al., 2015) the authors explain that, ‘the future of SRS lies in smartphone applications and other use of pre-existing mobile technology’. According to the authors, the development of web-based SRS technology accessed via smartphones has reduced the cost of implementing SRS in the classroom, both for the students and the university.SRS has been widely used in the past through devices called clickers (Blasco, Buil, Hernández-Ortega & Sese., 2013), were students

can give an immediate feedback to the lecturer questions. Although their positive impact on students learning experience, clickers are of limited functionality and flexibility (Coca & Slisko, 2013; Dakka, 2015). Also, clickers are not free of charge; apart from the purchasing cost, students also need to pay an activation fee each semester they use it in class (Bojinova & Oigara, 2011). Socrative software is a novel popular approach to SRS which especially enables formative assessment of students' understanding of the course content.

Socrative software

In this study Socrative was used to as the SRS software to get instant feedback from students. Socrative is a popular online SRS which gives instructors an opportunity to easily manage quizzes and other instructive activities for their learners. It also allows instructors to observe their learners' progress through feedback and evaluate their responses immediately. Moreover, Socrative is a smart SRS that empowers teachers by engaging their classrooms in a series of educational exercises and games (www.socrative.com).

The main reason of using Socrative is the fact that it supports the construction of versatile question types as well as collaborative features between different teams (Dakka, 2015). Also, unlike clickers, Socrative is a web-based SRS that requires no software to load and no set up to be done; a smartphone with a web browser and

Internet access is all one needs. Also, Socrative can be accessed free of charge, rendering its use affordable for both students and universities (Green, 2014).

Socrative is very simple and takes very little time to login to and it can be run on smartphones, laptops, and tablets. Instructors are able to arrange a variety of exercises and manage the process of quizzes. Since the results of the quizzes or exams can be displayed on the projector screen, it engages all students in the classroom. This is a way of in-class assessment of student understanding that is carried out easily. Socrative based SRS can also be used for assessing the learners. If learners write their names when accessing the instructors' virtual room it is possible to give a grade and keep their answers. This option is very helpful and useful for instructors who are used to assessing their learners' knowledge regularly by implementing short tests. It is possible to view the learners' result reports online as a spreadsheet file.

For the time being, research about Socrative is done by several researchers in some subjects. For instance, studies have been conducted in the following courses: in Computer Architecture on 38 male students in third semester et al., 2014), in Econometrics on 65 undergraduate students in third semester (Piatek, 2014), in Physics on a sample of 36 prospective teachers, studying for a degree in Primary Teaching (Coca & Slisko, 2013), in Sports Management on a sample of 65 first year Sports students (Dervan, 2014), in Architecture (Wang, Aanesl & Gamnes, 2014), in Biology (Liu & Taylor, 2012), and in English Language Teaching on 146 students of the second

semester from different departments (Balta & Kaya, 2015). Almost all of the researchers' goals were to use technology in their lectures to increase engagement, motivation, enjoyment, creativity, attention, learning of their students and to integrate technology in their lectures. The general observation about the use of Socrative in those lectures mentioned above is positive. The researchers found Socrative helpful and useful for their students' engagement, motivation, and learning.

In a survey conducted at the Institute of Technology in Dublin by Dervan (2014), results showed that the student response system is reliable and convenient according to students' positive feedback. In this survey, categorically, 65% of students *strongly* agreed (and 35% agreed) that using Socrative enhanced their engagement during lectures. 35% *strongly* agreed (and 50% agreed) that using Socrative corrected deficiencies in their learning. 23% *strongly* agreeing (and 50% agreeing) that using Socrative facilitated their understanding of material concepts. Socrative was also used in Econometrics lectures at the University of Copenhagen and arrived at the conclusion that Socrative is an advantageous and feasible device, but it depends on instructors (Piatek, 2014). In a learning and teaching experiment conducted by Dakka (2015), the author attempted to assess student engagement in higher education. The author used Socrative software to get student paced assessments. The experimental results showed that Socrative student paced assessments enhanced students' performance for the majority of the students. Also, the students expressed the general feeling that this

method improved their overall learning experience and team work. In their survey at Canik Basari University in Samsun in Turkey, Balta and Kaya (2015) examined the attitudes of private school students toward use of Socrative and the difference in their view according to gender. The authors have drawn the conclusion that "the favorable results of survey indicate that Socrative establishes an effective learning atmosphere and encourages the learning procedure." In addition, their statistics have shown the insignificant results between the attitudes of male and female that means there is no need to consider gender differences in class when using Socrative. The study results of another study (Coca & Slisko,2013) where the authors used Socrative for teaching physics showed that Socrative and the other effective tools like smartphones and tablets can help effective physics learning in the classroom. Moreover, there are studies which developed instructional design models that are based on Socrative. The purpose of the instructional design project developed by Hadiri (2015) was to evaluate the effectiveness of a learning module in instructing university faculty on how to use Socrative as a smart SRS for student assessment.

Although most of the abovementioned studies focus on the positive aspects of adopting SRS software and particular Socrative in classroom, there also are some negative concerns regarding the following examples: lecturers can be perceived to be more focused on technology than teaching; technical problems with the software or the lecturer's lack of experience are likely to create student dissatisfaction. Furthermore

concerns may be expressed by ‘competitive’ students who may not enjoy team workbwhile some students may experience anxiety when class-based response system test grades are included as part of their overall grade (Dervan, 2014).

The above mentioned studies derived from literature search indicates that researches on Socrative fall short. Especially, no quantitative experimental studies were found. This research is expected to be valuable for future studies on Socrative, particularly on the use of Socrative in physics area.

Formative feedback and Socrative

To end a lecture by summarizing the material that was just taught is usually advantageous. It is also suggested to begin with a review of the prior lecture, to help learners to remember and make sure that all the learners are on the same page beforehand to begin a lecture. The SRS proposes an option and that is very appealing: The learners can be given a summary survey on the most important part of the lecture. When starting the lecture, it will help them to remember what they have gained thus far, and make them more interested in future lectures. When finishing the lecture, it will encourage them to combine the most significant points of the lecture, which will possibly help them recollect what they just acquired. Studies have indicated that carrying out a short test at the end of the lecture enhances memory over time (Bligh,

1972). As a result of using Socrative, learners obtain immediate feedback on how they answered quizzes (Biggs & Tang, 2011).

Numerous researches have proven that direct feedback has considerable advantageous outcomes on the language acquisition of learners (Juwah et al., 2004). For instance, feedback has been proved to be a facilitator to enhance learner achievement. In addition, time period feedback is very vital and Socrative gives a chance to learners to obtain feedback in real time that experiments have shown to be powerful (Molloy and Boud, 2014). The authors also conclude that there is an idea, supported by instructors, that there are a number of common feedback examples which have great effects if delivered at once, post-task engagement.

The SRS can be used for getting feedback from the learners on the instructors' lectures and this is another useful feature (Biggs & Tang, 2011). Instructors can also use the SRS to get feedback on the entire lecture. For example, Socrative presents a choice called 'exit ticket', in which place learners are asked to answer the following questions:

1. How well did you understand today's material?
2. What did you learn in today's class?
3. Please answer the teacher's question. (Stated by the instructor)

By asking these helpful questions instructors are able to obtain information about the process of the lecture, and have a chance to see the opinion of learners of the lecture. Those questions give exact feedback to the instructors, and hence help guide the next

lecture. If instructors need more feedback, they are frequently able to arrange their own short questionnaire and deliver it through Socrative to the learners as an alternative to the 'exit ticket'.

As a summary, studies show that first, when Socrative is used in the right place at the right time it can become a useful tool to help interplay between the instructor and the learners, also between the learners themselves, and to improve learning. Second, by using Socrative, instructors are able to obtain immediate feedback from their students which gives a chance for them to conduct formative assessments in their classes.

Research questions

This study was guided by the following quantitative and qualitative research questions:

1. What associations exist between students' attitudes about Socrative and their gender, grades and majors?
2. Which survey dimensions meet significant differences between students' attitudes about Socrative? These dimensions regard the variables of: advantage, belief, engagement, usability and enjoyment as emerged from the reviewed literature.
3. What are students' ideas about the results of the attitude survey they completed?

2. Methodology

A field test was conducted to examine the outlined research questions. The test followed a three-phase methodology to collect and interpret the data. In particular, the development and validation of the survey was done in the first phase, the collection and analysis of the quantitative data was the focus of phase two and the interpretation of the results of the second phase through the qualitative data was the aim of the third phase.

2.1 Participants and Procedure

The sample of this study involved 50 students from a university located in Middle Black Sea region of Turkey. The initial population was 74 students, forty and 34 students respectively form the civil engineering (CE) and molecular biology and genetic (MBG) departments had the physics courses. All students were required to take a first year algebra based physic course before proceeding to their main courses in their departments. The physic course engagement was the main reason for selecting these students to participate in the survey. Of them, 24 and 26 students from the former and the latter departments completed the survey, rendering a sample of 50 students who replied to the survey, representing roughly 68% of the students who signed up for both courses. The reason for this participation rate was the low number of students at the last lesson before the end of the semester. Of the 50 participants 27 were female and 23 were male students.

The survey questionnaire was administered to the students at the end of the 14 week spring semester. The online survey was applied at the end of the three lesson period and it took students about 10 minutes to complete the survey. It was an online survey system enabled by Socrative that delivers an automatic grading solution. Students who completed the survey were given bonus credit (five points added to their final grade) for trying their best on the survey.

Moreover, students' end of year physics grade out of 100 was 42.5 with a standard deviation of 25.7. The minimum approval grade was 45 out of 100.Also, physics grade and standard deviation in terms of major were as follow: MGB =46.3(26.8) and CE=37.8 (22.8). As we see, standard deviation was high and the fact that a few students with very low grades affected the general average score.

2.2 Instrument

An online survey questionnaire was developed and utilized to collect quantitative information on the attitudes held by students regarding Socrative in their physics courses. The survey instrument needed approximately three weeks to be developed. The survey was given in Turkish and translated to English for publication. Except for the demographic information the survey instrument consists of 27 items on a five-point Likert scale (Strongly Disagree=1, Strongly Agree=5) and has five dimensions; advantage, belief, engagement, usability and enjoyment.

During the development of the survey initially, we searched for the attitude surveys regarding Socrative and found fourresearch works: Piatek (2014), Awedh, Mueen, Zafar and Manzoor (2014), Dervan (2014), and Coca and Slisko (2013). By consulting the above previous surveys we decided for five dimensions to be appropriate for the survey. Secondly, we reflected each earlier surveys on the wall and discussed for the inclusion of the items. After this process 32 items were determined. Then, after one more elimination regarding inappropriate, irrelevant, similar and inapprehensible items, seven were removed. During the inclusion of the items the dimensions of the survey were taken into account. One item regarding the belief and one regarding enjoyment were added by the researchers. In other words, 25 items were adapted from previous surveys and two new items (11th and 23rd items) were added by the researchers (see Table 5 in Appendix). The initial Turkish version was overseen by two educational science researchers from our university. Upon their request two items having similar meanings were combined and one disassociated item was removed. Moreover, they requested minor changes concerning the meaning of three items.

For the translation process initially we translated the items accompanied by discussions. Since the survey items were relatively simple the translation process was easy. Then, two English language instructors (one of them was native English speaker) checked for valid transformation. Moreover, for checking the understandability of the items we had two students to score the survey while thinking loudly. It was observed

that both students scored the items without hesitation. As a conclusion, relatively a modest survey was developed, validated and translated. It can be seen in the appendix.

On the other hand, the Cronbach‘s alpha, the internal consistency of the survey items, was calculated for the reliability of the questionnaire. The alpha value obtained for the whole survey was 0.95, while for the dimension they were; advantage = 0.81, belief =0.89, engagement =0.85, usability =0.65 and enjoyment =0.93.

2.3 Implementation of the Socrative

The nature of teaching and learning changes along with the increase in accessibility to media resources, especially web based resources. In this study, one of the emerging web based technology was used, that is Socrative. One of the authors used Socrative during his physics courses in the second semester of the 2014-2015 academic year. Positive reactions of instructors and students from the use of Socrative in English learning classes in the same university encouraged the author to implement it in physics courses. In each of the two physics courses for MBG and CE majors, the first author used Socrative in his physics classes for about 14 weeks. The weekly physics course was three hours each of which was 50 minutes. The author used Socrative for about 25 minutes at the end of the third lesson each week. In other words, the author taught two different classes, one for MBG and one for CE majors, each had three hour-long periods each week and Socrative was used at the last class hour. Both classes were covering

electricity and magnetism topics. During the course the author presented the content along with class discussions, demonstrations, problem solving and computer assisted instruction (videos, animations etc.). Toward the end of the last class hour the author initiated the previously prepared quizzes on Socrative. These were quizzes composed of 4-5 multiple choice questions related to that week's topic. Approximately 15 minutes were enough to finish the quizzes. The last ten minute period were generally used for feedback. Moreover, when needed the instructor made a brief summary of the topic by focusing on the challenging concepts determined after the results of the quizzes.

A sample of screenshot of the interface showing an example of a question asked to students is shown in Figure 1. When clicked on the question appearing on the upper left-hand corner of the figure it enlarges and students read it easily.

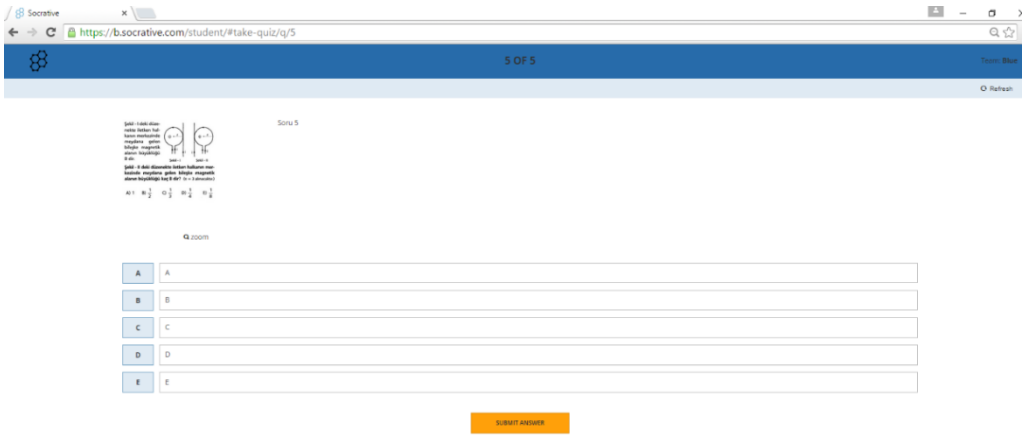


Figure 1. An example of question appearing on students' screens.

The author used the quizzes only for formative feedback. Before the quiz, groups of 3-4 students were formed. Students that didn't have smartphones or that had problems with Internet access were distributed among groups. Groups solved the problems projected on the screen collaboratively and posed a common answer. Each group's progress was seen on the screen also. Such competition between groups was exciting. An example of screenshot of the interface showing the progress of groups is given in Figure 2.

Figure 2. An example of screenshot showing the progress of groups.

The rate of correct answers of the groups was seen on the screen and naturally succeeding group was determined. As a second step the author reflected the rate of the correct responses for each of the questions and the questions with a low rate of correct solution were either solved by the instructor or by one of the volunteer students who agreed to answer. A screenshot of the interface displaying the rate of correct responds is indicated in Figure 3.

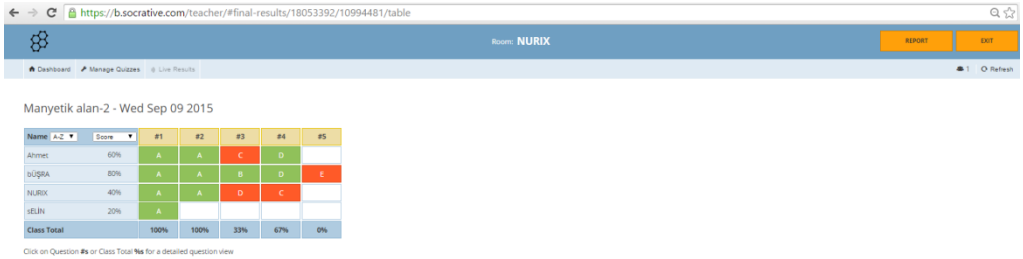


Figure 3. A screenshot displaying students' responses for each question.

The qualitative component (phase three) was conducted after the analysis of the quantitative data for participants' individual thoughts about the results of the attitude test using open ended responses. There was only one question in the second phase asking why the average attitude toward Socrative was slightly positive. This question was posed approximately one week after the application of the attitude survey during participants' final exam.

2.4 Data analysis

To answer the first research question, quantitative methods were used to analyze survey responses. Specifically, t-test, correlation, ANOVA and the subsequent Post Hoc analysis was used to evaluate the collected data. The t-test technique was used to determine whether any significant differences exist between the genders and also among the majors. The t-test analysis allowed the researchers to investigate the differences between students'attitudes toward Socrative in terms of gender and the majors they

attend. The Pearson correlation was used to see if there exists a relation between the students' physics grades and their attitudes.

For the second research question, analysis of variance technique was used to determine whether any significant differences exist among the dimensions of the attitude test. If the analysis of variance results was significant among the dimensions, a subsequent Bonferroni post-hoc test was carried out to determine where the particular alterations existed.

In the third research question, data from the open-ended responses were analyzed. Namely, students' shared thoughts about the moderate attitude towards Socrative was assayed.

3. Findings

On the five point Likert scale the evaluation ranged from 1 (strongly disagree) to 5 (strongly agree). Students' average score on the survey was 3.34 showing a slightly positive attitude. There were 27 items and five dimensions on the survey. The percentage of students' responses for each dimension is depicted in Table 1.

Table 1. Frequency of the responses for dimensions of the survey questionnaire

Dimension (# of items)	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)

Advantage (6)	8.3	40.0	29.3	18.0	4.3
Belief (5)	5.6	40.0	30.4	17.2	6.8
Engagement (6)	13.0	40.7	21.3	19.3	5.7
Usability (5)	20.0	48.8	15.2	12.0	4.0
Enjoyment (5)	7.6	34.8	32.0	16.0	9.6

Table 1 indicates that while the percentage for "agree" is the most for all dimensions, except for "belief" and "enjoyment" the percentage of "strongly disagree" is the least for all dimensions. This is an early indicator of positive attitude of students about the Socrative. Among all percentages some of them are striking: 20% of students strongly agree that Socrative is usable, 48.8% agree that Socrative is usable, 30.4% of students' belief is neutral, 19.3% disagree that Socrative engage them and 9.6% strongly disagree that Socrative is enjoyable.

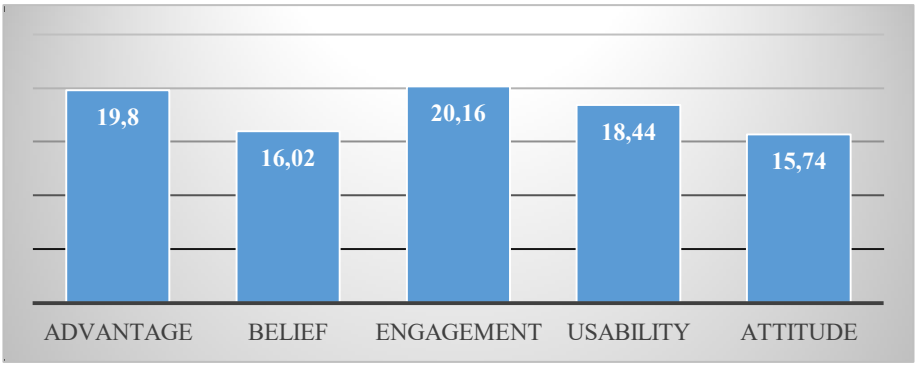
The first research question - "What associations exist between students' attitudes about Socrative and their gender, grades and majors?", included an investigation via t – test, and correlation analysis. T-test was conducted to find differences between the attitudes of male and female students as well as between the CE and MBG major students, and correlation analysis was done to find a relationship between students' grades and attitudes. Table 2 indicates both descriptive and inferential statistics for both grouping variables.

Table 2. Statistics for t-test analysis

Grouping variable				Levene's Test for Equality of Variances		t-test for Equality of Means		
		Mean	N	F	Sig.	t	df	p
Major	MBG	83.12	26	2.26	.14	-3.06	48	.004
	CE	97.79	24					
Gender	Female	86.11	27	0.55	.46	-1.73	48	.091
	Male	94.91	23					

Table 2 displays a significant difference (p = .004) between the attitudes of MGB and CE majors' students. In other words, the mean of CE students (97.79) is statistically higher than that of MBG (83.12) students. However, the difference between the attitudes of female and male students appear insignificant (p=.091) with means of 86.11 and 94.91 respectively. Additionally, correlation analysis disclosed that an insignificant (p=.278) correlation of -.156 was found between students' attitudes and their first term physics grades. The correlation between attitudes and physics grades was also searched in terms of students' major. However, significant correlation was neither found between MBG students' grades and attitudes nor between that of CE students.

Students' attitudes on the dimensions of the survey (second research question) was also of the interest of this study. Figure 4 indicates the average attitude on



advantage, belief, engagement, usability and enjoyment dimensions of the survey.

Figure 4. Students' attitudes on dimensions of the survey questionnaire

As seen from Figure 4 students' engagement with Socrative stand higher when compared with other dimensions of the survey. Since the average scores on each dimension differ, ANOVA was conducted to reveal the significant differences. Analysis of variance results indicated noteworthy differences between groups (p=.003) at the .05 significant level. As a post hoc statistics Bonferroni analysis was run for multiple comparisons. Table 3 shows the mean differences between the dimensions along with other statistics, moreover, statistically significant differences are indicated by asterisks.

Table 3. Bonferroni analysis results

(I) group	(J) group	Mean Difference (I-J)	p	95% Confidence Interval	
				Lower Bound	Lower Bound
advantage	belief	3.78*	.000	1.34	6.22
	engagement	-.36	1.00	-2.80	2.08
	usability	1.36	1.00	-1.08	3.80
	enjoyment	4.06*	.000	1.62	6.50
Belief	engagement	-4.14*	.000	-6.58	-1.70
	usability	-2.42	.053	-4.86	.02
	enjoyment	.28	1.00	-2.16	2.72
engagement	usability	1.72	.467	-.72	4.16
	enjoyment	4.42*	.000	1.98	6.86
Usability	enjoyment	2.70*	.019	.26	5.14

Table 3 shows that the average score on the advantages of Socrative is significantly higher than both students' belief about Socrative and enjoyment of Socrative. Likewise, the differences between the pairs; belief-engagement, engagement-enjoyment and usability-enjoyment are all significant.

The results of the third research question "What are students' ideas about the result of the attitude survey they completed?" show a mix of responses from participants on the positive or negative attitude toward Socrative. Students who liked Socrative generally mentioned the instant feedback given by Socrative on the correctness of their solutions, easy accessibility, saving of time, leading to competition and enabling group work. In the third question, students mostly provided responses regarding the reason behind the moderate attitude toward Socrative. Most of the reasons mentioned included the difficulties associated with the technical problems such as the lack of a smartphone and the failure in Internet connection. One frustrating aspect of Socrative that many students shared, was the fact that Socrative only provided the questions, however, students needed paper and pencil when attempting to solve physics problems. Additionally several students mentioned that Socrative was also used by their biology course instructor for grading and it might have affected their attitudes. The following comments supplied by one of the students clarify both positive and negative attitudes.

"In fact, Socrative is a useful application but I chose negative items on the survey. Because even though we think we are living in a technological age, not

everyone can keep up with technology. Actually it is helpful to use applications like these to prepare learners for the upcoming technology and for using it. However, it is obvious that not everyone has the required devices for implementing Socrative quizzes. Our University should provide us tablets for applying such kind of materials. I think this is the leading fact in our classroom. Furthermore, there was one more issue for me: I prefer to solve questions individually. However, I liked having immediate feedback. Finally, learners should hold papers and pencils. It is generally believed that it is not effective, in my opinion, even carrying papers and pencils helps to educate us.

Although students' responses on third questions were subjective, they provide us with a basic overview of their positive and negative thoughts about Socrative. Table 4 below summarizes students' perceived advantages and disadvantages regarding particular features of Socrative usage.

Table 4. Student's perception on Socrative usage

Feature	Advantages	Disadvantages
Student performance	Instant feedback assists in achieving correct solutions; Time-saving	Physics problems are more easily solved when using paper and pencil
Internet and Technology	Easy access	Technical difficulties such as the lack of a smartphone/tablet and problems in Internet connection

Effect on students' and instructors' attitude	It encourages competition and team work	It might affects instructor's grading attitude; It can render individual work inconvenient

4. Discussion and Conclusion

This study probed how students' attitudes are associated to Socrative – a web based student response system. Specifically, it surveyed learners' attitudes about the usage of Socrative in two different algebra based physics courses in a university setting. It investigated certain student demographics and whether attitudes toward Socrative had any relationship with gender, major and grade. This study also discovered the ideas about the results of the attitude survey from the students' viewpoint in learning physics. The third research question explored the reason behind the slightly positive attitude toward Socrative. The results from the sole question asked to students after the attitude survey, resulted in mixed responses from students about the benefits and disadvantages of Socrative.

Statistical analysis of the first question revealed that students' overall attitudes about Socrative was moderate. However, the findings of other studies showed overwhelmingly positive feedback from students (Dervan, 2014; Liu & Taylor, 2012). The probable cause was the difficulty of the physics. When the Socrative was presented

for the first time, several students expressed pretty good reactions such as “wow this is the technology”, “our instructor knows how to use technology” and “how nice an application”. However, as time passed by, the difficulty of physics surpass the glamorousness of Socrative. The fact that students’ average physics grade was 42.5 (out of 100) support this interpretation.

Of the students participated to this study CE majors’ attitudes were more positive than that of MBG major students. When this result was declared to MBG students, they generally expressed that their biology course instructor had used the Socrative for only grading and their attitude were effect. Moreover, when the average scores on the survey are compared to their average physics grades it was seen that while the physics grades of the MBG major (46.3) was higher than that of CE (37.8), their average scores on the survey was less (83.1) than that of CE (97.8).

Based on the results of the analysis of the dimensions of the survey, it can be noted that Socrative plays an important role in students’ engagement possibly because of the students’ concern about the usage of smartphones for learning and immediate feedback that improves understanding. This finding is especially important for students who are not interested in course content. This is consistent with the findings of a study (Liu & Taylor, 2012) on the usage of Socrative in introductory biology and molecular biology service courses and the findings of Godzicki, Godzicki, Krofel and Michaels

(2013) who tried to increase motivation and engagement in elementary and middle school students through technology-supported learning environments.

For the third question, students who liked Socrative generally mentioned the practical use, time saving, immediate feedback, exchanging of opinions and enhancing engagement with the material. These findings support findings of several works (e.g. Dervan,2014; Liu and Taylor,2012; Coca and Slisko,2013). Some of the disadvantages mentioned included the lack of smartphone, problems in accessing the Internet and being in the need of paper and pencil to solve physics problems. Similar problems were previously reported by Balta and Kaya (2015).

In addition, during the implementation of Socrative in the physic course students were working in groups. Thus, this study indicated that using Socrative provides more opportunities for students during group work with Socrative when compared to individual works Similarly, Coca and Slisko (2013) found that Socrative facilitated argumentation and the exchange of opinions among students. Moreover, the results of the correlational analysis suggested that students' attitude toward Socrative has no relationship with achievement in physics. In other words, low physics achievers' attitude does not change significantly when compared to higher achieving students.

The current study steps on previous research works and extends them to collect a set of research dimensions regarding students' attitude towards Socrative usage. The

difference from previous works is that the current study includes in its analysis the five dimensions of advantage, belief, engagement, usability and enjoyment. As explained, the previous works' research items for every dimension were also adapted and two new items were added in thr current instrument.

As already mentioned, the current instrument has been evaluated in terms of validly and items' internal consistency. This renders our findings of important value and research contribution. Finally, compared to previous studies, this study can be considered as a complementary contributing step towards the deeper understanding of students' attitude towards the use of SRS and particular of Socrative software in physic courses.

5. Implications and Future Studies

The positive attitudes of students imply that Socrative is an effective replacement to physical response systems as it provides feedback in real time in the classroom. When Socrative is used as a tool for immediate feedback on lecture understanding, several questions (3-5) taking roughly 25 minutes can be safely accommodated in a lecture, especially since time needs to be permitted for informative student dialogue and analysis of difficult concepts. Based on the moderate effect of Socrative on students' attitudes we recommend the other instructors to used Socrative in their courses. More, our successful use of Socrative encourage us to assert that

providing immediate feedback to students and receiving instant feedback about the teaching-learning process can be achieved through Socrative. Other usages such as using Socrative to adjust instruction to address misconceptions may be more beneficial.

Coming studies should discover whether Socrative improves the understanding of the topic and whether using Socrative impacts achievement in the examination. Despite its scientific contribution, this study brings some limitations like the sample representation and the consideration of limited parameters. These could be addressed in future works. For instance, increasing the number of the participants using random sampling would support making a generalization about students' attitude and usage of Socrative. In addition to enlarging the sample size, the consideration of other parameters or different instrument could possibly lead to slightly different outcomes. Hence future research and re-evaluation is important. In addition, taking into consideration more variables like students' age (in case of different semesters) would possibly contribute in the deeper understanding of students' attitude towards Socrative engagement. Another remarkable study could be done on whether the instructors could encourage students' to use Socrative regularly to improve their scores. A longitudinal study might disclose how students' usage of Socrative changes over the period of their study and how it affects their attitude and achievement.

The attitude test developed and used in this study was filtered from several other studies. The survey was applied after expert view and high internal consistency

coefficient, calculated from the survey data, confirmed its reliability. However, because of the low number of participants the factor analysis was not conducted. Future studies can use the attitude test given in the Appendix and conduct factor analysis for validating the survey.

References

Aljaloud, A., Gromik, N., Billingsley, W., & Kwan, P.. (2015). Research trends in student response systems: A literature review. International Journal of Learning Technology. 10. 313. 10.1504/IJLT.2015.074073.

Awedh, M., Mueen, A., Zafar, B., & Manzoor, U. (2015). Using Socrative and Smartphones for the support of collaborative learning. *International Journal on Integrating Technology in Education, 3*(4), 17-24.

Balta, N., & Kaya, A. (2015) Taking advantages of technologies: using the Socrative program in English language teaching classes. *The fifth international research conference*, Tbilisi, Georgia.

Beatty, I. D. (2005). Transforming student learning with classroom communication systems. *EDUCAUSE center for applied research: Research bulletin*, Volume 2004, issue 3, 1-13.

Biggs, J., & Tang, C. (2011). *Teaching for Quality Learning at University*. McGraw-Hill, International.

Bligh, D. A. (1972). *What is the Use of Lectures*? Harmondsworth, Mdx.: Penguin Books.

Blasco-Arcas, L., Buil, I., Hernández-Ortega, B. & Sese, F. J. (2013). Using clickers in class. The role of interactivity, active collaborative learning and engagement in learning performance. Computers & Education, 62 (3), 102-110.

Bojinova, E.D., & Oigara, J.N. (2011). Teaching and Learning with Clickers : Are Clickers Good for Students ? Interdisciplinary Journal of E-Learning and Learning Objects, v.7.

Burnstein, R. A., & Lederman, L. M. (2003). Comparison of different commercial wireless keypad systems. *The Physics Teacher, 41*, 272-275.

Coca, D. M., & Slisko, J. (2013). Software Socrative and smartphones as tools for implementation of basic processes of active physics learning in classroom: An initial feasibility study with prospective teachers. *European Journal of Physics Education*, *4*(2), 17–24.

Dakka, M. S. (2015). Using Socrative to Enhance In-Class Student Engagement and Collaboration. *International Journal on Integrating Technology in Education. 4. 13-19.*

Dervan, P. (2014). Increasing in-class student engagement using Socrative (an online Student Response System). AISHE-J: *The All Ireland Journal of Teaching and Learning in Higher Education*, *6*(3).

Dufresne, R. J., Gerace, W. J., Mestre, J. P., & Leonard, W. J. (2005). ASK-IT/A2L: Assessing student knowledge with instructional technology. Retrieved June 2015 from http://arxiv.org/ftp/physics/papers/0508/0508144.pdf

Duncan, D. K., Hoekstra, A. R., & Wilcox, B. R. (2012). Digital devices, distraction, and student performance: Does in-class cell phone use reduce learning. *Astronomy education review, 11*(1), 1-4.

English, D. (2003). Audiences talk back: Response systems fill your meeting media with instant data. *AV Video Multimedia Producer, 25*(12), 22-24.

Hadiri, Y. (2015). Instructional Design project: Click it to Check it. Socrative for student assessment in higher education. PowerPoint presented at the Technology, Colleges, and Community Worldwide Online Conference, March, 19.

Heaslip, G., Donovan, P., & Cullen, J. G. (2014). Student response systems and learner engagement in large classes. *Active Learning in Higher Education*, *15*(1), 11-24.

Georgiev, T., Georgieva, E., & Smrikarov, A. (2004). M-learning-a New Stage of E-Learning. *In International Conference on Computer Systems and Technologies-CompSysTech, 4*(28), 1-4.

Godzicki, L., Godzicki, N., Krofel, M., & Michaels, R. (2013). *Increasing Motivation and Engagement in Elementary and Middle School Students through Technology-Supported Learning Environments*. (Master's thesis, University of Saint Xavier, Chicago, Illinois). Retrieved May 2015 from http://files.eric.ed.gov/fulltext/ED541343.pdf

Green, A. (2014) 'Significant returns in engagement and performance with a free clicker app', Social Science Research Network [online] http://ssrn.com/abstract=2447848 (accessed 14 June 2018).

Kolb, L. (2011). Adventures with cell phones. *Educational Leadership, 68*(5), 39-43.

Liu, D. Y., & Taylor, C. E. (2013, September). Engaging students in large lectures of introductory biology and molecular biology service courses using student response systems. *In Proceedings of The Australian Conference on Science and Mathematics Education* (formerly UniServe Science Conference).

Luu, K., & Freeman, J. G. (2011). An analysis of the relationship between information and communication technology (ICT) and scientific literacy in Canada and Australia. *Computers & Education, 56*(4), 1072-1082.

Macfarlane-Dick, D., Matthew, B., Nicol, D., Ross, D., & Smith, B. (2004). Enhancing student learning through effective formative feedback. *Higher Education Academy* (Generic Centre).

Manuguerra, M. & Petocz, P. (2011). Promoting student engagement by integrating new technology into tertiary education: The role of the iPad. *Asian Social Science, 7*(11), 61-65.

Molloy, E. K., & Boud, D. (2014). Feedback models for learning, teaching and performance. *In Handbook of research on educational communications and technology* (p. 413-424). Springer New York.

Piatek, R. (2014). Student Response System: Student Activation towards Better Learning in Large Classes A Practical Guide. Retrieved June 2015 from http://samf.ku.dk/pcs/english/forteachers/tlhe/projects/Remi_Piatek_TLHE_Project.pdf

Roblyer, M. D., & Wiencke, W. R. (2003). Design and use of a rubric to assess and encourage interactive qualities in distance courses. *The American journal of distance education, 17*(2), 77-98.

Windschitl, M. (2009, February). Cultivating 21st century skills in science learners: How systems of teacher preparation and professional development will have to evolve. *In Presentation given at the National Academies of Science Workshop on 21st Century Skills*, Washington, DC (Vol. 15).

Wang, A., I, Aanesl, A. Elvemo, & Gamnes, E., V. (2014) Three Social Classroom Applications to Improve Student Attitudes. *Education Research International Volume 2014, Article ID 259128*

Appendix

Table 5. Socrative attitude survey

Dimension	Item
Advantage	1. Lectures are more enjoyable with Socrative.
	2. Socrative provides to learn more from classmates.
	3. Socrative provides consultation when answering questions.
	4. Socrative enable to learn more in a short time.
	5. Answering question with Socrative is more comfortable.
	6. Socrative enables immediate feedback
Belief	7. It is believed that importance of Socrative will increase in the future
	8. Socrative should be used in all educational institutions.
	9. Socrative should be used in other subjects as well.
	10. Socrative is a phenomenal software.
	11. Using Socrative regularly increase achievement.
Engagement	12. Time is passing more quickly when using Socrative.
	13. Socrative is increasing interest in the subject.
	14. Socrative makes learners more active.
	15. Socrative permits collaboration during group working.
	16. Taking exams/quizzes with Socrative is more interesting.
	17. Using Socrative with tablets and smart phones increases interest in the subjects.
Usability	18. It is easy to connect Socrative through internet.
	19. Results of exams/quizzes can be seen in real time with Socrative.
	20. Percentage of the correct answers can be seen in real time with Socrative.
	21. Socrative is more functional than the usual exam/quiz system.
	22. Using Socrative is easy.
Enjoyment	23. I have positive feelings toward Socrative.
	24. I like Socrative when used in lectures.
	25. I would like the Socrative to be used permanently.
	26. I wish I had used Socrative before.
	27. I enjoy using Socrative.