EPC248 - THE EFFECT OF STUDENT RESPONSE SYSTEM (SRS) ON ACADEMIC PERFORMANCE AND SATISFACTION: A QUASI-EXPERIMENT WITH ACCOUNTING SCIENCE UNDERGRADUATE STUDENTS

Autoria

Vitor Hideo Nasu
UNIVERSIDADE DE SÃO PAULO

Luís Eduardo Afonso
UNIVERSIDADE DE SÃO PAULO

Resumo

This study aimed to analyze the effect of Student Response System (SRS) on accounting students? academic performance and satisfaction from a public higher education institution in Brazil. A recent version of SRS consists of the use of personal devices and a software both connected to the internet. Its operation is based on quizzes and, according to the literature, promotes environments of more interactivity and active learning. In this regard, a quasi-experiment was conducted during the 1st and 2nd bimester of the 2016 academic year of the education institution. It was divided into two parts (PT1 occurred in the 1st bimester and PT2 in the 2nd), with two classes of students (Class A and B) from a 4th year course of the accounting program. In PT1, Class A was selected as control group (CG) and Class B as treatment group (TG). In PT2, the groups were inverted. This procedure not only provided the opportunity for both classes to use the SRS but was also adopted to reduce threats to the validity of the method. At the end of the quasi-experiment, surveys were administered comprising of questions about the socio-economic profile of students and 10 questions to capture the students? satisfaction. Statistical tests indicated that SRS does not increase academic performance, even after controlling for individual, academic, and socioeconomic factors. Despite that, satisfaction questions analysis showed that students enjoyed using SRS, perceived that the equipment made classes more fun, and were generally satisfied with the technology.

THE EFFECT OF STUDENT RESPONSE SYSTEM (SRS) ON ACADEMIC PERFORMANCE AND SATISFACTION: A QUASI-EXPERIMENT WITH ACCOUNTING SCIENCE UNDERGRADUATE STUDENTS

ABSTRACT

This study aimed to analyze the effect of Student Response System (SRS) on accounting students' academic performance and satisfaction from a public higher education institution in Brazil. A recent version of SRS consists of the use of personal devices and a software both connected to the internet. Its operation is based on quizzes and, according to the literature, promotes environments of more interactivity and active learning. In this regard, a quasi-experiment was conducted during the 1st and 2nd bimester of the 2016 academic year of the education institution. It was divided into two parts (PT1 occurred in the 1st bimester and PT2 in the 2nd), with two classes of students (Class A and B) from a 4th year course of the accounting program. In PT1, Class A was selected as control group (CG) and Class B as treatment group (TG). In PT2, the groups were inverted. This procedure not only provided the opportunity for both classes to use the SRS but was also adopted to reduce threats to the validity of the method. At the end of the quasi-experiment, surveys were administered comprising of questions about the socio-economic profile of students and 10 questions to capture the students' satisfaction. Statistical tests indicated that SRS does not increase academic performance, even after controlling for individual, academic, and socioeconomic factors. Despite that, satisfaction questions analysis showed that students enjoyed using SRS, perceived that the equipment made classes more fun, and were generally satisfied with the technology.

Keywords: Student response system; Accounting science students; Academic performance; Satisfaction; Quasi-experiment.

1 INTRODUCTION

The progress of mobile technologies has been enabling the intensification of their use in multiple activities and environments. In the educational area, mobile-learning is a reflex of this picture. However, traditional education seems not to have followed a similar evolution. In this respect, Lea (2008) notes that conventional techniques of teaching (lectures and readings) are passive and neglect creating the enthusiasm which today's students look for in pedagogical processes. This feature is particularly important for accounting education. Behn et al. (2012) consider that the accounting courses have remained stagnant, even with advances in technology. Moreover, Gaviria, Arango, and Valencia (2015) noticed that sometimes students are not interested in the learning process because they consider boring and monotonous.

In this context, the use of the Student Response System (SRS) can be an alternative to promote greater students' involvement in classroom and provide positive learning experiences (Caldwell, 2007; Premuroso, Tong, & Beed, 2011; Zhu, 2007). This educational technology, in a more recent version (web-based SRS), consists of the use of personal devices, such as smartphones and tablets, and a software connected to the internet (Carnaghan, Edmonds, Lechner, & Olds, 2011). SRS operation is quiz-based and in general has the following steps: (1) professor displays a question on the screen, usually multiple choice; (2) students visualize, interpret, and answer through their personal devices; and (3) professor gives feedback to students about their performance in a graphical form, which is generated in real time by the software.

Today's undergraduate students have always had access to the internet and personal devices, resulting in new learning patterns (Pathways Commission, 2012). Therefore, the incorporation of education technologies to the pedagogic process is necessary to help the formation of the accounting professional (Gaviria et al., 2015; Pathways Commission, 2012). In addition, in a comprehensive literature review, Apostolou, Dorminey, Hassell, and Rebele (2016) reported that, so far, mobile technologies have not been explored in accounting education, reinforcing the need to test such tools to develop up-to-date education models.

Considering that mobile technologies have the potential to contribute to the teaching-learning process, Mula and Kavanagh (2009) evaluate that studies about the SRS are of great importance. Thus, we formulate the following research question: **What is the effect of SRS on accounting students' academic performance and satisfaction?** The general objective is to verify the effect of SRS on academic performance and analyze the students' satisfaction with this technological resource.

Section 2 presents the literature review, focusing on SRS potential benefits and challenges and prior studies on students' perceptions. Section 3 reports the article's methodology and procedure decisions. In the fourth section, results are reported and discussed. Finally, section 5 concludes and provides recommendations for future research.

2 LITERATURE REVIEW

2.1 Student Response System: potential benefits and challenges

Carnaghan et al.'s (2011) Kay and LeSage's (2009), Rana, Dwivedi, and Al-Khowaiter's (2016) literature review on SRS shows the benefits and challenges when using this technology in the learning process. *Anonymity* (Beckert, Fauth, & Olsen, 2009; Carnaghan et al., 2011; Marshall & Varnon, 2012; Mula & Kavanagh, 2009), *attention* (Beckert et al., 2009; Caldwell, 2007; Cummings & Hsu, 2007; Kay & LeSage, 2009; Lea, 2008; Marshall & Varnon, 2012; Premuroso et al., 2011; Segovia, 2008), *attendance* (Caldwell, 2007; Cunningham, 2008; Kay & LeSage, 2009; Rana et al., 2016; Zhu, 2007), *involvement and participation* (Caldwell, 2007; Carnaghan & Webb, 2007; Chui, Martin, & Pike, 2013; Eng, Lea, & Cai, 2013; Humphries & Whelan, 2009; Premuroso et al., 2011; Rana et al., 2016; Zhu, 2007), *active learning* (Carnaghan et al., 2011; Carnaghan & Webb, 2007; Edmonds & Edmonds, 2008, 2010; Kay & LeSage, 2009; Mula & Kavanagh, 2009; Premuroso et al., 2011; Zhu, 2007), and *immediate feedback* (Beckert et al., 2009; Carnaghan et al., 2011; Carnaghan & Webb, 2007; Chui et al., 2013; Cummings & Hsu, 2007; Edmonds & Edmonds, 2008; Eng et al., 2013; Lea, 2008; Marshall & Varnon, 2012; Mula & Kavanagh, 2009; Premuroso et al., 2011; Rana et al., 2016; Segovia, 2008; Yourstone, Kraye, & Albaum, 2008; Zhu, 2007) were identified as main potential benefits of SRS usage.

Anonymity makes students feel comfortable because even if they answer wrongly the questions, their peers cannot judge them as the answers are anonym. SRS also appears to help student attention, especially if it is employed regularly during the class. Once SRS system demands answers from students, they must pay attention to classes. Likewise, literature shows that SRS has potential to influence students' attendance. In fact, SRS can be utilized to register student presence as well as motivate them to come to classes. Student involvement and participation are essential benefits and serve as key motivation to employ SRS in the learning process. Given that students' involvement and participation in classes may have impact on other academic aspects (e.g. student satisfaction), this point should be emphasized. Similarly, SRS promotes an active learning environment, which is important for students to learn and to feel responsible for their own learning. This sense of responsibility may affect students' behavior positively (e.g., study habits), which in turn reflects on their academic achievement. Finally, immediate feedback provided by SRS cooperates with professors and students in multiple ways. For students, immediate feedback indicates how well they understand the subject and makes feasible to modify inadequate behavior before academic

evaluations. On the other hand, teachers can use immediate feedback to control the pace of their classes and to check students' understanding.

Regarding SRS challenges, we can observe the following: *technological problems* (Caldwell, 2007; Carnaghan et al., 2011; Cunningham, 2008; Rana et al., 2016; Zhu, 2007), *effective questions* (Caldwell, 2007; Zhu, 2007), *cheating* (Caldwell, 2007; Carnaghan et al., 2011; Cunningham, 2008), *loss of personal device* (Caldwell, 2007; Cunningham, 2008; Rana et al., 2016; Zhu, 2007), and *financial cost* of individual devices in case of infrared- and radio frequency-based SRSs (Caldwell, 2007; Carnaghan et al., 2011; Kay & LeSage, 2009; Mula & Kavanagh, 2009; Premuroso et al., 2011; Rana et al., 2016; Zhu, 2007).

Technological problems of any nature may appear before, during or after SRS usage. This point is one of the main negative aspects that students complain. In this sense, adjustments should be provided quickly in order to continue the activity. Literature reports that designing effective questions is challenging. Questions cannot be too basic or too hard. They must be consistent with answering time and desired level of content assessment. Writing effective questions and including them into classes demands practice and time, which some educators are not willing to spend energy on that. Cheating is also a concern for professors. Students can take colleague's device to respond questions for them, or to register their attendance. Thus, consequences of inadequate use of SRS must be disclosed clearly on the first day of class. Losing or forgetting personal devices may become another concern because students have to keep and utilize them to answer questions. Since they are small, it is not uncommon to lose or forget them at university or at home. Practices and policies to avoid this problem should be studied (e.g., bring your own device policy). Lastly, financial cost of devices represents one of the main aspects that students complain about, especially if they do not see positive returns from its use.

After exposing SRS's benefits and challenges, the use and adoption of SRS can be better assessed. Education institutions and professors must assure before adopting SRS that it will be effectively used in classes, by both professors and students. There are not restricted rules to incorporate SRS in the learning process, however, as Caldwell (2007) notes, it is necessary the alignment of SRS usage and the educational purposes of classes and institutions that are adopting it.

2.2 Studies on the SRS in accounting education: academic performance and satisfaction

Carnaghan and Webb (2007) conducted an experiment with the students from the Introduction to Managerial Accounting course to look at the SRS's impact on student's learning, involvement and satisfaction. The statistical tests carried out indicated that the SRS does not increase overall learning. In addition, on the contrary to what the literature states, the use of the SRS reduced the involvement of the student in relation to making and answering questions in the classes. At the end of the experiment, surveys were applied which showed that the students were satisfied with the technological resource.

Cummings and Hsu (2007) investigated the SRS's effect on the students' performance and satisfaction of four classes from the Tax Accounting course for two semesters. The multiple regression analysis indicated that Grade Point Average (GPA) has a positive impact on academic performance for both periods. However, SRS influenced the student's performance significantly only in the first semester. Students also reported satisfaction with SRS.

Edmonds and Edmonds (2008) tested the SRS's impact on the performance of students from the Introduction to Managerial Accounting course through a quasi-experiment. Findings indicated that the SRS positively influence academic performance. In addition, it was found that students with lower previous performance tend to obtain greater benefit when using SRS.

Segovia (2008) sought to quantify the SRS's impact on the learning of Introductory Accounting students. To do so, the 2002 Winter class answered online quizzes through the

WebCT and the 2003 Summer class answered quizzes with the assistance of the SRS. When comparing the general performance of both groups, it was observed that the Summer 2003 class obtained better performance. In addition, the surveys showed that students perceived they participated more in classes and that they preferred to use the SRS.

Humphries and Whelan (2009) tested the SRS's effect on learning with students from two courses (Business Communication and Principles of Accounting I). Statistical procedures indicated that there was no significant difference between the performances of both the control and treatment groups. In other words, the SRS did not have a significant impact on student's performance. Moreover, it was identified in a concordance scale of 0 to 10, that the students found it easy and fun to use the SRS.

Premuroso et al. (2011) examined the SRS's impacts on satisfaction and performance of the students from Introduction to Financial Accounting. An experiment was conducted with the Spring 2009 and 2010 classes. The first one was the control group and the latter, the treatment group. Regression analysis revealed that the SRS has a positive effect on the student's performance. In addition, the surveys applied at the end of the experiment for the treatment group showed that the students were satisfied with the technological resource.

Marshall and Varnon (2012) sought to understand the influence of the SRS's usage, both individually and in conjunction with the Peer Instruction technique, on the academic performance of the students from the Principles of Financial Accounting course. An experiment with a control and a treatment group was developed. It was observed that the SRS only has a significant positive impact on the performance of students when utilized with the Peer Instruction. In addition, the results of the survey applied on the last day indicated that, in general, the students noticed that the use of the SRS was beneficial.

Chui et al. (2013) studied the SRS's effect on confidence, effort, and performance of the students. For this purpose, a quasi-experiment was conducted with two classes from the Principles of Accounting course. As to the academic performance, it was noticed that the treatment group obtained better performance in the quizzes applied in class, but there was no statistically significant difference in the final grade.

Eng et al. (2013) investigated the SRS's impact on the performance of students from the Introduction to Financial Accounting course in two semesters (Fall 2009 and Spring 2010). Only the Spring 2010 class used the SRS. Surveys were applied to the Spring 2010 class at the beginning and the end of the research to check if the student's perception about the SRS varied over time. The Variance Analysis indicated that the Spring 2010 class obtained better performance. In addition, the surveys' findings pointed out that the students' perception regarding the SRS did not vary over time.

Literature review shows that the results about the SRS's impact on academic performance are inconclusive. While Carnaghan and Webb (2007), Chui et al. (2013), and Humphries and Whelan (2009) verified that SRS has no significant impact on the overall academic performance of students, Edmonds and Edmonds (2008), Eng et al. (2013), Premuroso et al. (2011), and Segovia (2008) obtained evidence that the SRS significantly increases student's performance. Yet, Marshall and Varnon (2012) verified that the SRS only increases the student's performance when used together with the Peer Instruction technique, and Cummings and Hsu (2007) observed that the SRS increased the students' performance only in one period of their study. Based on this scenario, Chui et al. (2013) affirm that further research is necessary.

Literature also suggests that SRS is positively perceived by students regarding their satisfaction. Evidence obtained by Carnaghan and Webb (2007), Cummings and Hsu (2007), Humphries and Whelan (2009), Marshall and Varnon (2012), Premuroso et al. (2011), Segovia (2008) supports that students were satisfied with this technology. Nevertheless, evaluating student satisfaction is still important to analyze the efficiency of the tool (Beckert

et al., 2009) and verify if the technology was properly incorporated into the educational process (Carnaghan & Webb, 2007).

Based on this review, the present study is different from the previous literature in four main aspects: (1) while most research in accounting education tested the radio frequency or infrared signal SRS models (Carnaghan & Webb, 2007; Cummings & Hsu, 2007; Eng et al., 2013; Humphries & Whelan, 2009; Premuroso et al., 2011; Segovia, 2008), we analyze the web-based one; (2) Chui et al. (2013) observed that research about the SRS in accounting education focuses on courses from the first years of the accounting program. In view of that, they suggest research in more advanced levels. For this reason, this study is developed in a course of the final year of the accounting sciences undergraduate program (senior students); (3) unlike previous studies, socio-economic variables are taken into consideration to control the academic performance of the students, such as family income.

2.3 Hypotheses of the study

SRS is considered a tool that encourages active learning (Carnaghan & Webb, 2007; Cunningham, 2008; Edmonds & Edmonds, 2008; Eng et al., 2013; Kay & LeSage, 2009; Lea, 2008; Mula & Kavanagh, 2009). In this environment, the students are encouraged to assume participating attitudes, as well as they become more responsible for their learning (Zhu, 2007). In this sense, students with more initiative in relation to their education can obtain better academic performance.

In addition, the immediate feedback provided by the SRS is another standout point. Kulik and Kulik's (1988) meta-analysis showed that feedback on academic activities is more effective when given instantly. Chui et al. (2013) and Yourstone et al. (2008) also agree with this perspective. Furthermore, Edmonds and Edmonds (2008) emphasize that immediate feedback helps students because it allows the monitoring of their performance each class, enabling a change study habits and, consequently, improving academic performance. Thus, based on these considerations and on the empirical evidence, we formulate the first hypothesis:

H1: The use of SRS increases accounting students' academic performance.

Another relevant aspect to be explored is the students' satisfaction in relation to the SRS because it may indicate the efficiency of that technology (Beckert et al., 2009). Also, studies suggest that the SRS provides a learning environment different from traditional teaching (Caldwell, 2007; Cunningham, 2008; Edmonds & Edmonds, 2010; Mula & Kavanagh, 2009; Premuroso et al., 2011; Zhu, 2007). Edmonds and Edmonds (2010) verified that students who used the SRS perceived more efficient educational environments, and favorable to active learning, as opposed to those who did not use it. Likewise, Cunningham (2008) and Mula and Kavanagh (2009) highlight that the use of SRS in the teaching-learning process decreases the passivity of traditional education, such as copying and memorizing. Due to this, students may feel more satisfied.

Moreover, literature shows that the SRS encourages interactivity in the classroom (Caldwell, 2007; Cunningham, 2008; Kay & LeSage, 2009; Lea, 2008). The interaction among classmates and with the professor is important for interpersonal relationships and academic performance, since students can learn from the exchange of experiences (Cohn & Johnson, 2006). In view of this, the interactivity can contribute to the general satisfaction of the students. Thus, we introduce our second hypothesis:

H2: Accounting students are satisfied when using SRS in the teaching-learning process.

3 METHODOLOGY

3.1 General characteristics

This research was carried out in a public tuition-free higher education institution located in the South region of Brazil in the 1st and 2nd bimester of the institution's 2016 academic year. Two groups of students, called Class A (n = 28) and Class B (n = 26) from the

Accounting for Diverse Entities course, were the participants. This course is mandatory in obtaining the Diploma in Accounting Sciences, is taught annually, and is offered in the 4th year of the program. Students learn to apply accounting knowledge in several corporate sectors: Industrial Accounting, Agribusiness Accounting (Agricultural and Livestock), Contracts of Construction and Real State Accounting, and Hospital Accounting. According to the course's planning, Industrial Accounting was taught in the 1st bimester and Agricultural Accounting in the 2nd bimester.

It was not possible to randomize the students into control and treatment groups because the classes had already been divided by the institution's criteria. In this case, the quasi-experiment was used as the research method (Gall, Gall, & Borg, 2003; Shadish, Cook, & Campbell, 2002). The method was structured based on the Non-equivalent Control Group Design (Gall et al., 2003), characterized by the non-random allocation of the participants in control and treatment groups and consists of a pre- and a post-test (Gall et al., 2003; Shadish et al., 2002). In this study, the pre-test refers to the initial tests for Industrial Accounting (1st bimester) and Agricultural Accounting (2nd bimester) administered on the first day of class to measure the student's previous knowledge. The post-test corresponds to the bimesterly tests of each subject, applied at the end of the bimester classes. The treatment, or intervention, is the use of the SRS. The treatment group (TG) represents the students who used the SRS, while the control group (CG) is the set of participants who did not use the SRS, but did an equivalent activity.

The quasi-experiment was divided into two parts: Part 1 (PT1) and Part 2 (PT2). PT1 and PT2 were developed, respectively, in the 1st and 2nd bimesters of the institution's 2016 academic year. In PT1, Class A was selected as CG and Class B as TG. In PT2, the groups were inverted. This procedure was done to facilitate the use of the SRS by the two classes and to try to reduce the Hawthorne effect, Imitation of Treatment and Resentful Demoralization, threats to the method validity (Gall et al., 2003; Smith, 2015). To illustrate, Figure 1 shows the research design.

Part 1 (1st Bimester)	Class A	Control Group (CG)	N-R	O_1		O_2
	Class B	Treatment Group (TG)	N-R	O_1	X	O_2
Part 2 (2nd Bimester)	Class A	Treatment Group (TG)	N-R	O_1	X	O_2
	Class B	Control Group (CG)	N-R	O_1		O_2

N-R = Non-randomization of the participants
O_1 = Pre-test (initial tests)
X = Treatment/Intervention (SRS use)
O_2 = Post-test (bimester test)

Figure 1. Research design
Source: Non-equivalent Control Group Design (Gall et al., 2003) adapted for two periods.

3.2 Choice of SRS

The researchers analyzed the characteristics of five types of web-based SRSs available (*ClickerSchool*, *I>Clicker*, *Kahoot!*, *Socrative* e *Quiz Socket*). Three criteria of choice were determined: (1) ease of use; (2) cost; and (3) usefulness for the course. Although all types were easy to use, only *Kahoot!* and *Quiz Socket* were entirely free of charge. Finally, the study chose *Kahoot!* (www.getkahoot.com) because it allows the insertion of images in questions and offers a competition system based on the allocation of points according to the response time and accuracy of the answer. In other words, the faster the students correctly answer the questions, the higher the score. The competition serves to encourage more interactivity and attention in the classes. Such characteristics increased the usefulness of the tool for the course in comparison to *Quiz Socket*, which offers only the use of quizzes.

3.3 Quasi-experiment: Part 1 (PT1)

PT1 was carried out in the 1st bimester of the institution's academic year. In that period, nine meetings were scheduled. The first class in PT1 was divided into three stages: (i) the professor provided general guidelines about the course; (ii) the researcher introduced the research to the students and collected the signatures referent to the Informed Consent Form; and (iii) the students took the initial tests for Industrial Accounting and Agricultural Accounting. The dates for the 2nd and 7th classes coincided with the holidays. The 3rd, 4th and 5th classes had the same activities. The teacher presented the class content, solved exercises in class and at the end of the classes, applied the quizzes as a way to reinforce the content. In the 6th class, there was no application of quizzes as the intention was exclusively to do more elaborated and long practical exercises. In view of that, it was not possible to use the SRS. In the 8th class, the quizzes were applied again. Finally, the 9th class was reserved for the bimesterly test for the Industrial Accounting subject.

Altogether, the CG and the TG answered 24 questions (4 quizzes) over the PT1 period. While the TG used cell phones (the SRS) to answer the questions, the CG received the quizzes printed on paper. Additionally, an answer sheet was handed to the CG, which should be returned to the instructor before the correction of the quizzes. This sheet was necessary for the calculation of the students "Quiz Index", which could range from 0 to 1 and represented the proportion of correct answers of the quizzes questions. The answer sheet was not handed to the TG because the errors and hits report for the questions came from the website of the SRS. Generally, the quizzes were applied at the end of the classes and all management of the SRS assisted activities was done in the professor's notebook.

In order to increase the internal validity of the study, the two groups had the same professor, access to the same material, received the same instructions and did the activities identically. The only difference was the use of the SRS by the TG (Class B). In addition, it is highlighted that the researcher did not take part in the classes, but only provided guidance to the course's professor about how to conduct the meetings.

Finally, two observations from the TG (Class B) were excluded because the student took the make-up exam, which differed from the exam applied to Class A and the other student only attended the 6th class, when the SRS was not used. Therefore, 52 students (Class A = 28 students; Class B = 24 students) effectively took part in the PT1 analysis.

3.4 Quasi-experiment: Part 2 (PT2)

PT2 was developed in the 2nd bimester of the 2016 academic year of the institution. It must be reminded that there was the inversion of the groups in this stage. Class A became the TG and Class B the CG. Nine meetings were scheduled for that period.

The first PT2 class was intended to review the Industrial Accounting test (1st bimester) and to introduce the 2nd bimester subject (Agricultural Accounting). Due to this, there was no time to utilize SRS. Classes 2nd to 6th took place similarly and as follows: (i) correction of previous exercises (when remaining); (ii) content explanation; (iii) doing practice exercises in class; and (iv) application of quizzes close to the end of class. The 7th class did not take place because the professor and the researcher were in an accounting academic event, which was already scheduled in the course planning. In the 8th class, the students took the bimesterly tests related to the Agricultural Accounting subject. As the students finished the evaluations, the professor in the classroom handed out the research survey. The survey consisted of questions about the socioeconomic profile of the students (gender, age, market job position, family income, etc.), together with 10 statements to which the students should assign a grade from 0 (totally disagree) to 10 (totally agree) in order to evaluate the student's satisfaction in relation to the SRS. Finally, the 9th class was reserved to review the bimesterly test.

Both groups answered 33 questions over the PT2 period. As in PT1, the quizzes were applied at the end of the classes to reinforce key aspects of the subjects. In addition, the same

instructions and materials were given to the students to increase the internal validity of the research. Finally, the 54 students taking part in the study (Class A = 28 students; Class B = 26 students) were considered in the PT2 analysis. However, only 53 students answered the 10 satisfaction statements part, as one student from Class B attended only one class in the 1st bimester and ended up not using the SRS.

4 RESULTS

4.1 Part 1 (PT1) results

Table 1 shows the profile of the CG and TG students from PT1. In comparison, it can be observed that there is a difference between the compositions of the groups per gender. While the CG is made up of 67.9% of male students and 32.1% of female students, the TG is made up of 50% of each gender. As to the placement in the job market, both groups are similar with the majority of CG and TG students working. Regarding the educational level of the father and the mother of the students, the groups are reasonably similar given that the category with the greatest presence is "high school" in both groups. It is noticed that CG and TG are similar as to the family income, since a large part of the students are included in the "over 5 minimum wages" band. Finally, the groups were also similar in relation to course repetition, as most of the students were taking the course for the first time.

Table 1 - Socio-demographic profile of the PT1 students: qualitative variables

Qualitative Variables	**CG (n = 28)**		**TG (n = 24)**		**General (n = 52)**	
(Part 1)	**freq.**	**%**	**freq.**	**%**	**freq.**	**%**
Gender	*28*	*100.0%*	*24*	*100.0%*	*52*	*100.0%*
Male	19	67.9%	12	50.0%	31	59.6%
Female	9	32.1%	12	50.0%	21	40.4%
Placement in the job market	*28*	*100.0%*	*24*	*100.0%*	*52*	*100.0%*
No activity	2	7.1%	0	0.0%	2	3.8%
Internship	2	7.1%	5	20.8%	7	13.5%
Job	24	85.7%	19	79.2%	43	82.7%
Education level – father	*28*	*100.0%*	*24*	*100.0%*	*52*	*100.0%*
Illiterate	1	3.6%	0	0.0%	1	1.9%
Elementary School	9	32.1%	5	20.8%	14	26.9%
Middle School	3	10.7%	5	20.8%	8	15.4%
High School	9	32.1%	12	50.0%	21	40.4%
Higher Education	4	14.3%	2	8.3%	6	11.5%
Postgraduate Program	2	7.1%	0	0.0%	2	3.8%
Education level – mother	*28*	*100.0%*	*24*	*100.0%*	*52*	*100.0%*
Illiterate	0	0.0%	2	8.3%	2	3.8%
Elementary School	10	35.7%	3	12.5%	13	25.0%
Middle School	2	7.1%	4	16.7%	6	11.5%
High School	11	39,3%	12	50.0%	23	44.2%
Higher Education	5	17.9%	2	8.3%	7	13.5%
Postgraduate Program	0	0.0%	1	4.2%	1	1.9%
Family Monthly Income	*28*	*100.0%*	*24*	*100.0%*	*52*	*100.0%*
Up to 1 Minimum wage	0	0.0%	0	0.0%	0	0.0%
1 to 3 minimum wages	5	17.9%	4	16.7%	9	17.3%
3 to 5 minimum wages	9	32.1%	9	37.5%	18	34.6%
over 5 minimum wages	14	50.0%	11	45.8%	25	48.1%
Repeat Student	*28*	*100.0%*	*24*	*100.0%*	*52*	*100.0%*
Yes	0	0.0%	2	8.3%	2	3.8%
No	28	100.0%	22	91.7%	50	96.2%

In relation to the quantitative characteristics (Table 2), it can be observed that the CG's (25.96 years) and TG's (24.92 years) average age are similar. The weekly time of study students dedicate to the course by the CG (2.18 hours) is greater than by the TG (1.64 hour). The groups have similar GPA (CG = 7.38 points; TG = 7.36 points). In the quizzes applied in the classroom, the CG (0.66) obtained better performance than the TG (0.53). Finally, the TG students (1.08 absences) missed more classes than the CG students (0.43 absences).

Statistical tests were conducted to analyze the existence of significant differences about the quantitative characteristics. The t-test for independent groups was employed, but not all the data followed their assumptions. Hence, the Mann-Whitney's U test was carried out, which is the non-parametric alternative (Cohen, Manion, & Morrison, 2007; Smith, 2015). We observe that there was only a statistically significant difference for the Quiz Index ($p < 0.01$). In other words, the CG had better performance than the TG on quizzes. It is contrary to the results of Chui et al. (2013) and Edmonds and Edmonds (2008). However, this does not necessarily indicate that the SRS reduces performance as the students are still in the learning stage. In all other aspects, the groups are similar.

Table 2 - Characteristics from PT1 students: quantitative variables

Quantitative Variables (Part 1)	CG (n = 28)		TG (n = 24)		General (n = 52)	
	Average	SD	Average	SD	Average	SD
Age (years)[1]	25.96	5.20	24.92	5.47	25.48	5.30
Weekly time of study (hours)[2]	2.18	2.04	1.64	1.42	1.93	1.79
GPA[2]	7.38	0.73	7.36	0.72	7.37	0.71
Quiz Index[2]	0.66***	0.16	0.53***	0.10	0.60	0.15
Absences (quantity of absences)[2]	0.43	0.83	1.08	1.86	0.73	1.43

[1] t-test (two-tailed). *** p < 0.01; ** p < 0.05; * p < 0.10.
[2] Mann-Whitney's U test. ***p <0.01; **p < 0.05; * p < 0.10.

Based on the descriptive statistics of the qualitative and quantitative characteristics of the students, it is generally noticed that the groups are similar. Hence, the next step is the H1 hypothesis test (*The use of SRS increases the academic performance of the students)*. For that, it is necessary to compare the students' initial performance. Considering that the observable characteristics of the groups are similar and the initial academic performances are statistically equal, the difference in the final performance can be attributed to the treatment effect (Gall et al., 2003), that is, the use of SRS. If the initial performance of the groups is not the same, it is necessary to test the variation of the performances, as well as other factors that might be causing the difference in the initial performance of the groups to try to better explain the treatment effect (Gall et al., 2003).

Table 3 reports the comparison of the CG and TG's initial performance in PT1. According to the t-test result for the independent groups ($t = 0.880$; $p > 0.10$), there is no statistically significant difference between the initial performances. Therefore, if there is variation in the final performance, it can be attributed to the treatment effect (use of SRS).

Table 3 – CG's and TG's initial performances comparison: PT1

Initial Performance	n	Average	*t*	df	p (two-tailed)
Control Group	28	3.85	0.880	50	0.383
Treatment Group	24	3.40			

In line with the H1 hypothesis' prediction (SRS increases students' performance), the comparison between the final performances was carried out in a one-tailed way. Table 4 reports the t-test results (one-tailed) for the independent groups ($t = 0.97$; $p > 0.10$). We observe that there was no statistically significant difference between final performances of the groups and, therefore, this is the first indication SRS does not increase students' performance.

Table 4 - CG's and TG's final performances comparison: PT1

Final Performance	N	Average	*t*	df	p (one-tailed)
Control Group	28	6.43	0.97	50	0.833
Treatment Group	24	5.81			

Additionally, with the intention of finding evidence to support the results presented in Table 4, H1 hypothesis was subject to an additional empirical procedure. A linear regression model was specified, given by the Equation (1).

$$PERF_i = \alpha + \beta_1.SRS_i + \beta_2.GEN_i + \beta_3.AGE_i + \beta_4.WTS_i + \beta_5.GPA_i + \beta_6.QUIZ_i + \beta_7.INEXAM_i + \beta_8.ABS_i + \beta_9.WORK_i + \beta_{10}.FEDUC_i + \beta_{11}.MEDUC_i + \beta_{12}.INCOME_i + \mu_i \quad (1)$$

Where: *PERF* = performance in the bimesterly test (from 0 to 10 points); *SRS* = 1 if the student used the SRS, 0 otherwise; *GEN* = 1 for male and 0 for female; *AGE* = age in years; *WTS* = weekly time of study (in hours) informed by the students; *GPA* = Students' GPA by the time of this research; *QUIZ* = Quiz Index (proportion of hits on quizzes, from 0 to 1); *INEXAM* = performance in the initial exam (from 0 to 10 points); *ABS* = number of absences in the classes; *WORK* = placement in the job market (binary variable for each category of Table 1); *FEDUC* = educational level of the father (binary variable for each category); *MEDUC* = educational level of the mother (binary variable for each category); and *INCOME* = monthly family income (binary variable for each category).

From Equation (1), we used Ordinary Least Squares to estimate three models: (a) the "Simple" model intended to verify the SRS's impact on student's performance without controlling through other variables; (b) the "Intermediary" model aimed to understand the SRS's effect on student's performance considering students' individual and academic variables; and (c) the "Full" model sought to analyze the SRS's influence on academic performance by controlling for students' socioeconomic variables (education of parents, monthly family income and placement in the job market), as well as the individual and academic factors. As to the regression technique assumptions, it can be highlighted that the Intermediate and Full models had acceptable levels of meeting the assumptions while the Simple model had not (normal residuals). Table 5 reports the results.

In none of the three models, the "*SRS*" variable is significant. In other words, the use of SRS did not influence the academic performance. This finding is consistent with the studies of Carnaghan and Webb (2007), Chui et al. (2013), Humphries and Whelan (2009), in which no significant effects of the SRS on student overall academic performance were found. On the other hand, Edmonds and Edmonds (2008), Eng et al. (2013), Premuroso et al. (2011), and Segovia (2008) observed a positive impact of the SRS on the students' performance.

We observe that "*INEXAM*" positively affected academic performance ($p < 0.01$), as the Intermediary and Full models show. Similarly, Full model indicates that "*WTS*" also had a positive effect on students' performance (coeff. = 0.344; $p < 0.05$). On the other hand, "*ABS*", according to the Full model, is harmful to the student's performance (coeff. = -0.325; $p < 0.10$). Moreover, the Intermediary model indicated that the student's gender "*GEN*" was significant to explain "*PERF*", where male students obtained worse performance (coeff. = -0.907; $p < 0.10$). Finally, students' socioeconomic variables were not significant ($p > 0.10$).

Table 5 - Results of the Regression Models: PT1

***PERF* (Part 1)**	**Model**		
	Simple	**Intermediary**	**Full**
Constant	6.432***	-3.913	-3.39
	(0.432)	(2.967)	(5.346)
SRS	-0.620	0.276	0.737
	(0.636)	(0.523)	(0.756)
GEN		-0.855*	-0.979
		(0.492)	(0.614)
AGE		0.023*	0.0495
		(0.455)	(0.0589)
WTS		0.208	0.344**
		(0.131)	(0.161)
GPA		0.664*	0.573
		(0.366)	(0.464)
QUIZ		3.211	3.752
		(2.144)	(2.890)
INEXAM		0.771***	0.782***
		(0.166)	(0.226)
ABS		-0.225	-0.325*

		(0.158)	(0.183)
WORK (placement in the job market)	No	No	Yes
FEDUC (father's education level)	No	No	Yes
MEDUC (mother's education level)	No	No	Yes
INCOME (monthly family income)	No	No	Yes
N	52	52	52
R-squared	0.019	0.649	0.726
Adj. R-squared	0.000	0.584	0.518
F	0.95	9.96	3.49
Prob. F	0.335	0.000	0.001

*** p < 0.01; ** p < 0.05; * p < 0.10. Standard errors between brackets.

4.2 Part 2 (PT2) results

In PT2, Classes A and B were inverted. Class A became the TG and Class B the CG. Considering that students taking part in the study were practically the same as in PT1, their sociodemographic profile remained similar. As Table 6 shows, it is possible to notice the difference of the groups' composition per gender, with TG having more male students and CG more female students. In addition, most of the students work and the majority of the parents of TG and GC students have completed high school. Regarding the monthly family income, the groups are also similar. Most of the students have a family income over 5 minimum wages in both groups. Finally, most of the students had never used the SRS before this research and were not repeat students in the course.

Table 6 - Socioeconomic profile of the PT2 students: qualitative variables

Qualitative Variables (Part 2)	**TG (n = 28)**		**CG (n = 26)**		**General (n = 54)**	
	freq.	**%**	**freq.**	**%**	**freq.**	**%**
Gender	*28*	*100.0%*	*26*	*100.0%*	*54*	*100.0%*
Male	19	67.9%	12	46.2%	31	57.4%
Female	9	32.1%	14	53.8%	23	42.6%
Placement in the job market	*28*	*100.0%*	*26*	*100.0%*	*54*	*100.0%*
No activity	2	7.1%	0	0.0%	2	3.7%
Internship	2	7.1%	5	19.2%	7	13.0%
Job	24	85.7%	21	80.8%	45	83.3%
Education level – father	*28*	*100.0%*	*26*	*100.0%*	*54*	*100.0%*
Illiterate	1	3.6%	0	0.0%	1	1.9%
Elementary School	9	32.1%	6	23.1%	15	27.8%
Middle School	3	10.7%	5	19.2%	8	14.8%
High School	9	32.1%	13	50.0%	22	40.7%
Higher Education	4	14.3%	2	7.7%	6	11.1%
Postgraduate Program	2	7.1%	0	0.0%	2	3.7%
Education level – mother	*28*	*100.0%*	*26*	*100.0%*	*54*	*100.0%*
Illiterate	0	0.0%	2	7.7%	2	3.7%
Elementary School	10	35.7%	3	11.5%	13	24.1%
Middle School	2	7.1%	4	15.4%	6	11.1%
High School	11	39.3%	13	50.0%	24	44.4%
Higher Education	5	17.9%	2	7.7%	7	13.0%
Postgraduate Program	0	0.0%	2	7.7%	2	3.7%
Family Monthly Income	*28*	*100.0%*	*26*	*100.0%*	*54*	*100.0%*
Up to 1 Minimum wage	0	0.0%	0	0.0%	0	0.0%
1 to 3 minimum wages	5	17.9%	4	15.4%	9	16.7%
3 to 5 minimum wages	9	32.1%	9	34.6%	18	33.3%
over 5 minimum wages	14	50.0%	13	50.0%	27	50.0%
Previous use of the SRS	*28*	*100.0%*	*26*	*100.0%*	*54*	*100.0%*
Yes	1	3.6%	1	3.8%	2	3.7%
No	27	96.4%	25	96.2%	52	96.3%
Repeat Student	*28*	*100.0%*	*26*	*100.0%*	*54*	*100.0%*
Yes	0	0.0%	3	11.5%	3	5.6%
No	28	100.0%	23	88.5%	51	94.4%

As to the quantitative aspects of the students (Table 7), the mean ages (TG = 25.96 years; CG = 24.92 years), the GPA (TG = 7.38 points; CG = 7.27 points) and the Quizz Index (TG = 0.66; CG = 0.71) of both groups are very similar. It is also observed that the TG (2.12 hours) studied more than CG (1.70 hour) per week, and was absent less in class (TG = 1.93 absences; CG = 2.62 absences). Similarly to PT1, same statistical tests were conducted in PT2. The two groups were not statistically different for any quantitative characteristic.

Table 7 - Characteristics from PT2 students: quantitative variables

Quantitative Variables	**TG (n = 28)**		**CG (n = 26)**		**General (n = 54)**	
(Part 2)	**Average**	**SD**	**Average**	**SD**	**Average**	**SD**
Age (years)[1]	25.96	5.20	24.92	5.28	25.46	5.22
Weekly time of study (hours)[1]	2.12	1.85	1.70	1.53	1.92	1.70
GPA[1]	7.38	0.73	7.27	0.82	7.33	0.77
Quiz Index[1]	0.66	0.12	0.71	0.16	0.69	0.14
Absences (quantity of absences)[1]	1.93	1.76	2.62	1.94	2.26	1.87

[1] t test (two-tailed). *** p <0.01; ** p < 0.05; * p < 0.10.

In order to analyze the treatment effect on academic performance, it is necessary to verify if the initial performances of the groups are similar. As presented in Table 8, we can see that performances in the initial tests are different (t = -1.883; sig < 0.10). In view of this, the difference between the final performances of the groups may not be entirely and necessarily attributable to the use of SRS. Then additional tests were conducted to check other possible variables that caused this difference. Since gender is a more distinct characteristic between TG and CG, we compared groups' initial performances per gender. A significant difference was found between male students from TG and CG. Therefore, the variation between the initial and final performances of the groups can be partially attributed to the student gender and possibly other variables (e.g., student motivation), and not necessarily and entirely to the use of the SRS. In Part 1, however, these variables did not impact TG and CG initial performances relevantly or they somehow compensated each other.

Table 8 - CG's and TG's initial performances comparison: PT2

Initial Performance	**n**	**Average**	***t***	**df**	**p (two-tailed)**
Treatment Group	28	4.02	-1.883	52	0.065
Control Group	26	3.17			

Final performances of the groups were then compared through t-test (one-tailed), accordingly with our prediction. Thus, Table 9 shows that there was no significant difference between the performances. Similar to what was verified in PT1, we observed that the SRS does not increase the academic performance of the students (p > 0.10). This is another evidence that rejects H1 hypothesis.

Table 9 - CG's and TG's final performances comparison: PT2

Initial Performance	**n**	**Average**	***t***	**df**	**p (two-tailed)**
Treatment Group	28	8.15	0.3280	52	0.6279
Control Group	26	8.27			

In PT2, the effect of SRS on academic performance was also explored by running the three linear regression models: "Simple", "Intermediary" and "Full", based on Equation (1) but with PT2 data. We emphasize that the Simple model did not meet the normality of residuals assumption and, although reported in Table 10, it will not be analyzed.

We observe that the coefficients of the "*SRS2*" variable were not statistically significant (p > 0.10) for any of regression models. This evidence strengthens the idea that the SRS does not increase the academic performance of the students. It is also consistent with the result of PT1 and findings of Carnaghan and Webb (2007), Chui et al. (2013), Humphries and Whelan (2009). However, it differs from the results of Edmonds and Edmonds (2008), Eng et al. (2013), Premuroso et al. (2011), and Segovia (2008). It partially supports the findings of Cummings and Hsu (2007) who found, in one period of their study, that the SRS does not have a positive impact on the student's performance. These results suggest that the SRS does

not increase academic performance. Regarding the other variables, "*GEN2*" was significant do explain "*PERF2*" in the Intermediary model and "*GPA2*", "*INEXAM2*" and "*ABS2*" were significant in both Intermediary and Full models.

Table 10 - Results of the Regression Models: PT2

***PERF2* (Part 2)**	**Model**		
	Simple	**Intermediary**	**Full**
Constant	8.265***	4.565**	7.800***
	(0.265)	(1.808)	(2.807)
SRS2	-0.121	-0.456	-0.608
	(0.368)	(0.295)	(0.366)
GEN2		0.237	0.140
		(0.284)	(0.308)
AGE2		-0.077***	-0.0528
		(0.028)	(0.0350)
WTS2		-0.032	0.0848
		(0.083)	(0.0948)
GPA2		0.672***	0.814***
		(0.196)	(0.249)
QUIZ2		0.246	-1.277
		(1.015)	(1.196)
INEXAM2		0.265***	0.229**
		(0.094)	(0.103)
ABS2		-0.131*	-0.180*
		(0.076)	(0.095)
WORK2 (placement in the job market)	No	No	Yes
FEDUC2 (fathers' education level)	No	No	Yes
MEDUC2 (mother's education level)	No	No	Yes
INCOME2 (monthly family income)	No	No	Yes
N	54	54	54
R-sqd	0.002	0.560	0.700
Adj. R-sqd	-0.017	0.482	0.487
F	0.11	7.16	3.290
Prob. F	0.744	0.000	0.001

*** p < 0.01; ** p < 0.05; * p < 0.10. Numbers between brackets represent the standard errors.

4.3 Analysis of students' satisfaction

In this last stage of the empirical procedure, we analyze the results of the satisfaction questions. Table 11 shows the descriptive statistics. At first, the Cronbach Alpha coefficient was calculated for the set of satisfaction questions. This technique was adopted to verify the reliability of the scale about the internal consistency of the items that measure the same construct (Hair Jr., Black, Babin, & Anderson, 2009). We chose to call the construct "Student Satisfaction". The result ($\alpha = 0.9345$) is above the 0.7 acceptance level recommended (Hair Jr. et al., 2009; Smith, 2015), indicating that the questions are consistent to measure the students' satisfaction.

Emphasis should be given to questions Q1 (average = 9.59), Q2 (average = 9.55) and Q10 (average = 9.28), which obtained the three highest averages in the concordance scale. On the other hand, question Q5 (average = 6.57) obtained the lowest average; nevertheless, the students tend to agree more than to disagree. Despite that, the higher values of medians suggest the majority of students are more likely to agree with the questions. These results provide evidence that H2 hypothesis is then supported.

Table 11 - Descriptive analysis of the satisfaction questions

Question	**Student's satisfaction ($\alpha = 0.9345$)**	**n**	**Min.**	**Max.**	**Median**	**Mean**	**SD**
Q1	I enjoyed using the SRS.	53	5	10	10	9.59	0.93
Q2	SRS made the class more fun compared to traditional classes.	53	5	10	10	9.55	1.14
Q3	I am satisfied with the questions	53	6	10	10	9.21	1.12

	prepared for the use with SRS.						
Q4	I am satisfied with the SRS as a teaching tool.	53	6	10	10	9.25	1.09
Q5	My satisfaction with the course has increased due to the use of the SRS.	53	0	10	7	6.57	2.76
Q6	The competition provided by the SRS has increased my satisfaction with the traditional classes.	53	0	10	8	7.55	3.06
Q7	I am satisfied with the interactivity the SRS provides.	53	0	10	10	8.96	1.94
Q8	I had a positive impression about the SRS use in the accounting education.	53	0	10	10	8.96	1.70
Q9	I am satisfied with the incorporation of the SRS into the course.	53	0	10	10	9.26	1.62
Q10	I am satisfied with the use of the SRS.	53	0	10	10	9.28	1.61

Another relevant analysis is the comparison of students' perception between the groups as to their satisfaction. Because the t-test assumptions were not met, the Mann-Whitney U test was used as a non-parametric alternative (Cohen et al., 2007; Smith, 2015). Table 12 shows that all the significances are above the 0.05, indicating that the distribution of the questions are the same between the groups. Therefore, both classes were identically satisfied with the SRS.

Table 12 – Comparison of classes satisfaction with SRS

Question	Null Hypothesis	p
Q1	Q1 distribution is the same between the classes.	0.808
Q2	Q2 distribution is the same between the classes.	0.334
Q3	Q3 distribution is the same between the classes.	0.288
Q4	Q4 distribution is the same between the classes.	0.213
Q5	Q5 distribution is the same between the classes.	0.718
Q6	Q6 distribution is the same between the classes.	0.600
Q7	Q7 distribution is the same between the classes.	0.823
Q8	Q8 distribution is the same between the classes.	0.394
Q9	Q9 distribution is the same between the classes.	0.666
Q10	Q10 distribution is the same between the classes.	0.708

Finally, students' satisfaction was explored using the Spearman's correlation matrix (Table 13), because the data did not follow the normal distribution. Most of the questions are correlated among each other significantly. Correlation between question Q9 and Q10 stands out, obtaining the highest coefficient. This indicates that the higher the satisfaction with the incorporation of the SRS to the course, the higher the satisfaction with the use of the SRS, in general. Similarly, correlation between questions Q5 and Q10 stands out, suggesting that the increase in students' satisfaction with the course and the use of the SRS are related.

Table 13 – Spearman's correlation matrix: satisfaction questions

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
S1	1.000									
S2	0.462***	1.000								
S3	0.459***	0.357***	1.000							
S4	0.548***	0.291**	0.648***	1.000						
S5	0.173	0.219	0.084	0.188	1.000					
S6	0.369***	0.364***	0.362***	0.356***	0.499***	1.000				
S7	0.541***	0.454***	0.593***	0.575***	0.213	0.565***	1.000			
S8	0.521***	0.474***	0.438***	0.611***	0.229*	0.532***	0.636***	1.000		
S9	0.728***	0.555***	0.583***	0.544***	0.251*	0.543***	0.797***	0.683***	1.000	
S10	0.764***	0.587***	0.589***	0.629***	0.233*	0.387***	0.658***	0.674***	0.812***	1.000

*** p < 0.01; ** p < 0.05; *p < 0.10.

Satisfaction questions proved to be consistent to measure the proposed construct (α = 0.9345). Moreover, the descriptive analysis provided evidence that the students were satisfied

when they used SRS in the educational process. The Mann-Whitney's U test suggested that the classes perceived equally the use of SRS in terms of satisfaction. Finally, the Spearman's correlation matrix showed, in general, high correlations between the questions, indicating that SRS can contribute to the improvement of several aspects associated with the academic environment and students' class expectations.

5 CONCLUSIONS

Mobile technologies are increasingly present in social spaces and activities, improving quality of life. Likewise, technologies have the potential to improve the traditional education field (Escueta, Quan, Nickow, & Oreopoulos, 2017). Then, they need to be tested. This perspective is especially important for accounting education because even with advancements in technology and the emergence of new learning patterns, several accounting courses have remained stagnant (Behn et al., 2012). Lea (2008) also states that conventional techniques fail to produce the enthusiasm that current undergraduates expect from the teaching-learning processes. Thus, the insertion of educational technologies can contribute to the provision of more interactivity when compared to traditional education (Escueta et al., 2017; Premuroso et al., 2011). In this sense, this study sought to test the SRS, a resource that can provide an environment of active learning (Carnaghan & Webb, 2007; Edmonds & Edmonds, 2008, 2010; Eng et al., 2013; Kay & LeSage, 2009; Lea, 2008).

Evidence obtained by the quasi-experiment suggests that SRS does not increase academic performance. Statistical tests for the final performance comparison between TG and CG showed no significant difference. In addition, the regression models of PT1 and PT2 also indicated that SRS does not have a significant impact on students' performance, after controlling for individual, academic, and socioeconomic factors. This evidence supports that SRS does not increase accounting science students' performance and, therefore, H1 hypothesis is rejected. On the other hand, the satisfaction questions indicated that the students enjoyed using the SRS, declared that the device makes the class more fun, and, in general, were satisfied with the technology. These findings support that students are satisfied when using SRS. Thus, hypothesis H2 is not rejected.

Regarding the limitations of the study, three points stand out: (1) the first limitation concerns the method. The quasi-experiment is less robust than the experiment because it does not include the randomizing stage of the participants. Nevertheless, procedures reducing the threats to the method validity were adopted; (2) the students provided the data for the academic performance analysis (such as gender, age, weekly time of study, etc.). Because of this, the results of the statistics tests are restricted to the veracity of the data the students declared. However, it must be highlighted that this is a usual problem that can affect self-reported studies; and (3) the analysis of students' satisfaction was subject to biases (e.g., halo effect), given that it is about perception. In this respect, the scales of the questions from the questionnaire were prepared in order not to suggest or create biases. The label was only assigned to the edges of the scale. Even so, it is recognized that there might have been biases in the answers due to the presence of the professor who applied the questionnaire or by the fact the students knew they were taking part in a research.

As suggestions for further studies, it is recommended to test the web based SRS in distance education. Most of the research has focused on onsite teaching because the models of radio frequency and infrared signal have maximum limits of physical proximity. However, the web based SRS can be used through internet and, thus, can be useful to distance education as well. In addition, research into the use of SRS for asynchronous activities is encouraged. Research with this intention is required to structure educational models assisted by updated teaching methods (Apostolou et al., 2016).

Finally, the implications of this study can be seen from two perspectives: (1) academic; and (2) efficiency. In the first, the discussion about educational technologies

contributes to the improvement of pedagogical practices. In order to capture the attention of the students in the classroom, the *way* we teach is as important as *what* is taught. Thus, the incorporation of interactive technologies in the learning process is essential, as Escueta et al. (2017), Gaviria et al. (2015), and Premuroso et al. (2011) defend it. From the efficiency perspective, Pike (1991) suggests that satisfaction is a key-factor for retention and persistence of students in courses. When verifying that students are satisfied with web-based SRS, public and private education institutions can adopt this technology with the intention of retaining students. The decrease in withdrawals allows the more efficient use of resources, especially of fixed costs incurred in the offer of programs and courses. This factor is particularly the case in Brazil, where drop out is a serious problem in higher education. Considering that the web-based SRS tested in the research has rather reduced costs, this device can be an opportunity to provide different environments and activities from the traditional education. In view of that, although the SRS does not increase academic performance, its use is justifiable from the perspective of the students' satisfaction. Reflection about the SRS must be continuous in order to allow a better understanding of how this technological resource can contribute to the development of general education and, more specifically, accounting education.

REFERENCES

Apostolou, B., Dorminey, J. W., Hassell, J. M., & Rebele, J. E. (2016). Accounting education literature review (2015). *Journal of Accounting Education*, *35*, 20–55.

Beckert, E., Fauth, E., & Olsen, K. (2009). Clicker satisfaction for students in human development : differences for class type , prior exposure , and student talkativity. *North American Journal of Psychology*, *3*(11), 599–612.

Behn, B. K., Ezzell, W. F., Murphy, L. A., Rayburn, J. D., Stith, M. T., & Strawser, J. R. (2012). The Pathways Commission on Accounting Higher Education: Charting a National Strategy for the Next Generation of Accountants. *Issues in Accounting Education*, *27*(3), 595–600.

Caldwell, J. E. (2007). Clickers in the large classroom: Current research and best-practice tips. *CBE - Life Sciences Education*, *6*, 9–20.

Carnaghan, C., Edmonds, T. P., Lechner, T. A., & Olds, P. R. (2011). Using student response systems in the accounting classroom: Strengths, strategies and limitations. *Journal of Accounting Education*, *29*(4), 265–283.

Carnaghan, C., & Webb, A. (2007). Investigating the Effects of Group Response Systems on Student Satisfaction, Learning, and Engagement in Accounting Education. *Issues in Accounting Education*, *22*(3), 391–409.

Chui, L., Martin, K., & Pike, B. (2013). A quasi-experimental assessment of interactive student response systems on student confidence, effort, and course performance. *Journal of Accounting Education*, *31*(1), 17–30.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education* (6th ed.). New York: Routledge/Taylor & Francis Group.

Cohn, E., & Johnson, E. (2006). Class Attendance and Performance in Principles of Economics. *Education Economics*, *14*(2), 211–233.

Cummings, R. G., & Hsu, M. (2007). The effects of student response systems on performance and satisfaction: an investigation in a tax accounting class. *Journal of College Teaching & Learning*, *4*(12), 21–26.

Cunningham, B. M. (2008). Using Action Research to Improve Learning and the Classroom Learning Environment. *Issues in Accounting Education*, *23*(1), 1–30.

Edmonds, C. T., & Edmonds, T. P. (2008). An Empirical Investigation of the Effects of SRS Technology on Introductory Managerial Accounting Students. *Issues in Accounting*

Education, *23*(3), 421–434.

Edmonds, C. T., & Edmonds, T. P. (2010). An examination of the links between SRS technology and an active learning environment in a managerial accounting course. In A. H. Catanach & D. Feldmann (Eds.), *Advances in Accounting Education* (pp. 81–100). Emerald Group Publishing Limited.

Eng, L. L., Lea, B.-R., & Cai, R. (2013). Use of Clickers for Assurance of Learning in Introductory Financial Accounting. In *Advances in Accounting Education: Teaching and Curriculum Innovations* (Vol. 14, pp. 269–291).

Escueta, M., Quan, V., Nickow, A. J., & Oreopoulos, P. (2017). Education technology: An evidence-based review. *NBER Working Paper Series*.

Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research: an introduction* (7th ed.). Boston: Allyn & Bacon.

Gaviria, D., Arango, J., & Valencia, A. (2015). Reflections about the Use of Information and Communication Technologies in Accounting Education. *Procedia - Social and Behavioral Sciences*, *176*, 992–997.

Hair Jr., J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate data analysis* (7th ed.). Pearson Prentice Hall.

Humphries, S. A., & Whelan, C. (2009). Effectiveness of Interactive Technology in Business Education. *Business Education Innovation Journal*, *1*(2), 56–61.

Kay, R. H., & LeSage, A. (2009). Examining the benefits and challenges of using audience response systems: A review of the literature. *Computers & Education*, *53*(3), 819–827.

Kulik, J. A., & Kulik, C.-L. C. (1988). Timing of Feedback and Verbal Learning. *Review of Educational Research*, *58*(1), 79–97.

Lea, B.-R. (2008). Clickers Adoption in a Small Class Setting. *Decision Line*, *39*(4), 7–11.

Marshall, L. L., & Varnon, A. W. (2012). An Empirical Investigation of Clicker Technology in Financial Accounting Principles. *Journal of Learning in Higher Education*, *8*(1), 7–18.

Mula, J. M., & Kavanagh, M. (2009). Click Go the Students , Click-Click-Click : The efficacy of a student response system for engaging students to improve feedback and performance. *E-Journal of Business Education & Scholarship of Teaching*, *3*(1), 1–17.

Pathways Commission. (2012). *The Pathways Commission: Charting a national strategy for the next generation of accountants*.

Pike, G. R. (1991). The effects of background, coursework, and involvement on students' grades and satisfaction. *Research in Higher Education*, *32*(1), 15–30.

Premuroso, R. F., Tong, L., & Beed, T. K. (2011). Does using clickers in the classroom matter to student performance and satisfaction when taking the introductory financial accounting course? *Issues in Accounting Education*, *26*(4), 701–723.

Rana, N. P., Dwivedi, Y. K., & Al-Khowaiter, W. A. A. (2016). A review of literature on the use of clickers in the business and management discipline. *International Journal of Management Education*, *14*(2), 74–91.

Segovia, J. (2008). Personal response system and its effects on student learning. *Accounting Instructors' Report*, *Winter*, 1–5.

Shadish, W. R. ., Cook, T., & Campbell, D. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. *Houghton Mifflin Company*.

Smith, M. (2015). *Research methods in accounting* (3rd ed.). London: Sage.

Yourstone, S. a, Kraye, H. S., & Albaum, G. (2008). Classroom Questioning with Immediate Electronic Response: Do Clickers Improve Learning? *Decision Sciences Journal of Innovative Education*, *6*(1), 75–88.

Zhu, E. (2007). Teaching With Clickers. *Center for Research on Learning and Teaching - Occasional Papers*, 1–8.