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# *WHY IS PLICKERS A RELEVANT PEDAGOGY ALTERNATIVE FOR ACCOUNTING EDUCATORS? A REFLECTION ON DISTINCT TYPES OF STUDENT RESPONSE SYSTEMS (SRS)*

# POR QUE O PLICKERS É UMA ALTERNATIVA PEDAGÓGICA RELEVANTE PARA OS EDUCADORES CONTÁBEIS? UMA REFLEXÃO SOBRE DISTINTOS TIPOS DE SISTEMA DE RESPOSTA DO ESTUDANTE (SRE)

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***ABSTRACT***

*Plickers is a type of student response system (SRS) and is a relatively new educational technology tool that can assist the teaching and learning processes through an engaging quiz-based activity. Despite that, little research has been conducting on it thus far. I was unable to retrieve any published work in accounting academic journals on Plickers. Then, this study aims to show why Plickers is an important pedagogy alternative for accounting educators, comparatively to other types of SRS. To this end, I have discussed Plickers' features and functionality. Subsequently, I compared Plickers and other kinds of SRS regarding essential issues in its usage. Next, I described preliminary findings on Plickers and, finally, I presented my final thoughts based on what I have shown throughout the paper. I argue that Plickers has essential advantages over other types of SRSs that may relevantly influence educational institutions' and faculty's decision to adopt it, and these include (i) less dependency on technology and technical support, (ii) lower costs, and (iii) the potential learning benefits are similar to previous versions of SRS, particularly concerning students' involvement, participation, and performance. Additionally, Plickers is flexible in terms of utilizing it at distinct levels of education and courses, especially in face-to-face education. I discuss the implications for practice and provide suggestions for future studies in the final section of the paper.*

***Keywords:*** *Plickers, Student response system, Educational technology, Accounting education.*

**RESUMO**

O Plickers é um tipo de sistema de resposta do estudante (SRE) e é uma tecnologia educacional relativamente nova que pode auxiliar os processos de ensino e aprendizagem através de uma envolvente atividade baseada em *quiz*. Apesar disso, pouca pesquisa foi conduzida até o presente momento. Não consegui identificar nenhum trabalho publicado sobre Plickers em periódicos acadêmicos de contabilidade. Dessa forma, o objetivo deste estudo é mostrar por que o Plickers é uma alternativa pedagógica importante para os educadores contábeis, comparativamente a outros tipos de SRE. Para esse fim, discuti as características e a funcionalidade do Plickers. Subsequentemente, comparei o Plickers e outros tipos de SRE em relação a questões importantes. Em seguida, descrevi os achados preliminares sobre Plickers e, finalmente, apresentei meus pensamentos finais com base no que mostrei ao longo do artigo. Argumento que o Plickers tem vantagens importantes sobre outros tipos de SREs, que podem influenciar a decisão das instituições de ensino e do corpo docente de adotá-lo. Entre elas, estão: (i) a menor dependência de tecnologia e suporte técnico, (ii) menores custos e (iii) benefícios potenciais semelhantes às versões anteriores do SRE, particularmente no que concerne ao envolvimento, à participação e ao desempenho dos alunos. Além disso, o Plickers é flexível em termos de utilização em diferentes níveis de educação e cursos, especialmente no ensino presencial. Discuto as implicações para a prática e forneço sugestões para estudos futuros na seção final do artigo.

**Palavras-chave**: Plickers, Sistema de resposta do estudante, Tecnologia educacional, Educação contábil.

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## 1. INTRODUCTION

Student response systems (SRSs) are pedagogical resources that enable processes of inquiring and answering. Different types of SRS were developed over time, such as the infrared-based (IR), the radiofrequency-based (RF), and the web-based ones (CARNAGHAN; EDMONDS; LECHNER; OLDS, 2011). In 2011, a new type of SRS referred to as "Plickers" was created by Nolan Amy when he was a Math teacher at a low-income high school in California, United States (US) (https://www.crunchbase.com/person/nolan-amy). Like other types of SRS, the Plickers enables faculty to engage students during the classes through quiz-based activities. Basically, Plickers consists of three parts: "(1) Plicker cards for each student, (2) an instructor smartphone with camera and Plickers app (available for both iOS and Android), and [desirably] (3) an internet-connected computer with projector screen and web browser" (WOOD; BROWN; GRAYSON, 2017, p. 3). The instructor downloads the Plickers app on his/her device that will be used to both develop the quizzes and scan the QR-codes when the students raise their cards to answer the questions. The questions are exposed through the projector to the entire class. Because Plickers works through a simple process, it does not demand a significant amount of time from faculty and students to learn how to use it. Some general instructions should be enough.

As new generations of students expect more visual stimulus and are often characterized as being fast-paced and multitasking (LEA, 2008; SPRAGUE; DAHL, 2010), Plickers can help to bring interactivity to the classroom. More specifically to accounting education, there are some motivations to support why accounting instructors should consider using Plickers. First, it has to do with the profession stereotype, which characterizes accountants as being introverted, methodical, systematic, anti-social, boring, and number experts (JACKLING, 2014). This stereotype is related to a routine recording and tax calculations, which are accounting practices taught at the undergraduate level. For this reason, accounting students sometimes find that the education process is tedious and demotivating (GAVIRIA; ARANGO; VALENCIA, 2015). When using Plickers, accounting instructors show some initiative to deliver content differently from traditional teachings, such as lecturing. It also assists in improving the classroom humor once it makes classes more fun (WUTTIPROM; TOEDDHANYA; BUACHOOM; WUTTISELA, 2017).

Second, research has found that business students – in which accounting ones are categorized – reported cheating more than students taking other undergraduate programs (MCCABE, 2005; MCCABE; TREVINO, 1995; RETTINGER; JORDAN, 2005). For example, McCabe and Trevino (1995) surveyed more than 6,000 students from 31 US top universities and found that business students were more inclined to cheat than their non-business colleagues. Plickers, as I will discuss in the next section, has specific mechanisms to decrease or even prevent students from engaging in cheating practices.

Third, Plickers should be adopted from an innovation perspective. Some accounting scholars consider that accounting programs have become stagnated in terms of using technology to teach (PATHWAYS COMMISSION, 2012), even when there are forces to incorporate it into higher education (PINCUS; STOUT; SORENSEN; STOCKS; LAWSON, 2017). Plickers could assist in increasing the innovation level of the accounting programs, especially for its potential to generate data at rapid speed to be analyzed by educators, accounting department heads, and even accounting professional bodies. Similarly, in an interview study with 13 experienced accounting academics, Watty, McKay, and Ngo (2016) raised some barriers for accounting faculty to avoid technology adoption. Among them, the instructor's ability to deal with new tools and redesign his/her classes to accommodate them is a relevant one (SPRAGUE; DAHL, 2010; WATTY et al., 2016). However, despite it may be true for other types of technology, Plickers is easy and simple to use (WOOD et al., 2017); therefore I argue that this aspect is not a fundamental obstacle.

Although in this introductory discussion I placed more emphasis on Plickers' positive aspects, there are some essential challenges to use it. Thus, the objective of this study is to present the value of Plickers for accounting educators critically. Because there are now multiple versions of SRS, it seems to be opportune to compare Plickers and other existing SRSs. This comparison may reveal some features that justify why the creation of Plickers was necessary.

This study seeks to contribute to accounting education literature and practice in three directions. First, I would like to call attention to Plickers because accounting educators do not widely know and utilize it yet (CARNAGHAN et al., 2011). Then, presumably, its potential benefits are being ignored. Second, I extend Carnaghan et al.'s (2011)discussion by comparing Plickers and other types of SRS. Carnaghan et al. (2011) did not consider Plickers because it was launched after their study. Third, to the best of my knowledge, there is no published work in accounting education journals about Plickers thus far. Then, as a first step, I seek to present its features and capabilities before recommending it to an empirical test.

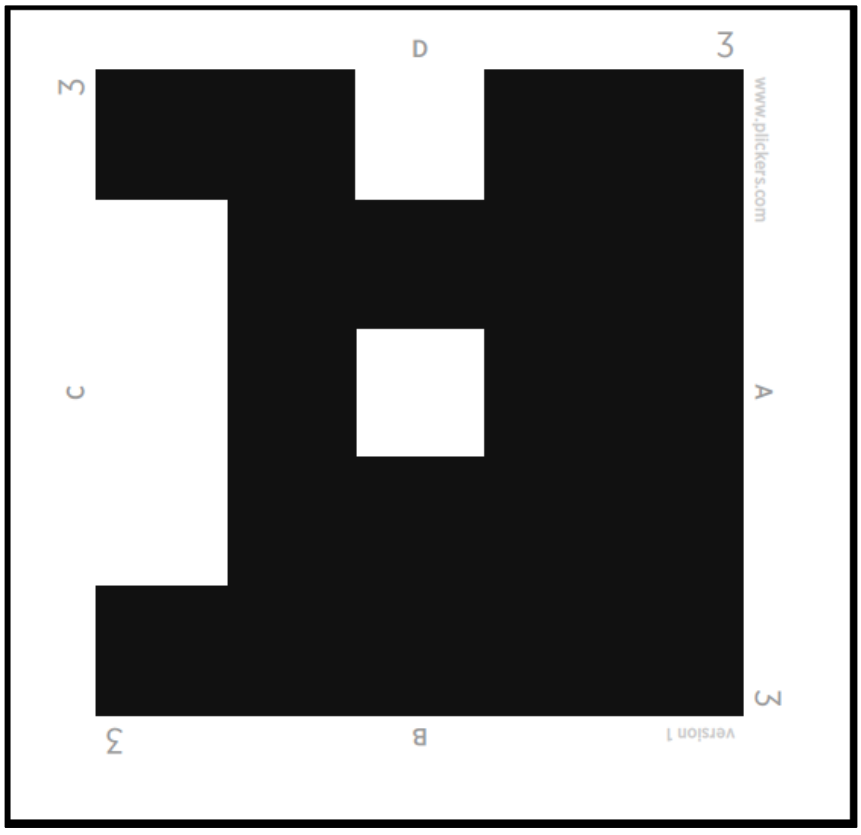
The remainder of this paper is structured as follows. Next section presents the literature review on Plickers' functionality and features. Subsequently, I compare Plickers with other types of SRS, focusing on key features, as well as I discuss the theoretical foundation for using it. Then, I present preliminary studies on Plickers. Finally, I report my final thoughts.

## 2. PLICKERS' FUNCTIONALITY AND KEY FEATURES

Plickers is a new type of SRS, and a critical feature is its simplicity (WOOD et al., 2017). Plickers consists of paper cards with printed QR-codes on them that are scanned by the instructor's mobile device. Figure 1 shows an example of it. Cards can be plasticized or laminated to increase its durability, like Krause, O'Neil, and Dauenhauer (2017) and McCargo (2017) recommend. According to Howell, Tseng, and Colorado-Resa (2017), 63 distinct Plickers cards are available to be printed currently. Reusing QR-code cards is a good practice to avoid paper waste, and faculty should keep this in mind.

Detecting QR-code is the primary objective of the Plickers software/mobile app, and this is probably the most crucial task that the faculty must ensure when using Plickers. Otherwise, Plickers activity may not be developed appropriately. According to Chng and Gurvitch (2018), it takes about ten seconds to scan 60 cards.

**Figure 1. Plickers card.**




Source: http://juliebenton.weebly.com/plickers.html.

Each card has a different QR-code to avoid response conflict, and each side of the cards has a letter (A, B, C, and D) to represent the options to the questions. To get a valid response, students must hold up the QR-code cards until the instructor's device scans it. The top of the card indicates the chosen alternative. For instance, in Figure 1, the answer is option D. The Plickers cards also have a number attached to them. This feature allows faculty to associate students with the cards and then collect more specific data, even though it is not mandatory to make Plickers work. In Figure 1, the number is three, which could represent "Anna," for example.

The general functionality of Plickers is simple. First, the professor exposes a multiple-choice question through a Powerpoint presentation projector, for instance. Then, the instructor gives students some time to think about the questions. For interactivity and involvement purposes, the given time should be short, but sufficient for students to respond. Mula and Kavanagh (2009) gave students ten seconds to answer. General guidelines from Sullivan (2009) indicate that while classes up to 30 students should be given from 15 to 20 seconds per question, 30 seconds should be sufficient for classes with 30-100 students. For classes of more than 100 students, such as in large lecture halls, Sullivan (2009) recommends one minute per question. Finally, students respond to the question by raising their cards, which are scanned by the instructor's device.

After these steps, the Plickers software provides immediate feedback in graphic forms, usually histograms. The instructor can also see the feedback per student. This process repeats as the questions are asked. Albeit Plickers can be used in an offline mode, it is recommended that faculty's mobile phones be connected to the internet for instant data synchronization and to maximize its usefulness (KRAUSE et al., 2017). Additionally, it is encouraged to use a personal computer attached to a multimedia projector to display the response histograms and to support the activity in general, although it may not be needed since there are diverse manners to expose a multiple-choice question. Figure 2 provides a visualization of how Plickers works in the classroom.

**Figure 2. Plickers in the classroom.**

Source: https://www.historymatters365.com/history-matters-365-blog/using-plickers-for-formative-assessment.

It is observable that each student is raising his/her QR-code card in a particular position, which represents the response choices. Students must hold up their cards until the Plickers app scans them. Because the process is not entirely electronic, it would be challenging for Plickers to be employed in distance education. It may also have some difficulties in capturing students' answers in large lecture halls, where classes can reach hundreds of students since there might be a juxtaposition of cards due to a large number of students one in front of another, not to mention the limited number of cards available (63). Despite that, Plickers may still be a good alternative for small and medium classrooms, though.

Some key features of Plickers motivate instructors to use it. First, Plickers is a comprehensive academic tool since it permits that all students participate actively in class at the same time. This would be very hard to achieve without a structured response system. It is argued that there will always be a few students disinterested in learning, and they probably will raise their Plickers cards without purpose. Definitely, it is not the expected conduct and may jeopardize the general active learning environment. However, I must highlight that this behavior is not a particular issue of Plickers, but all teaching methods. Despite that, Plickers has potential to make students interested in learning by making them participate through a "no one left behind" policy, which may produce a sense of fairness because every student, either shy or spontaneous, has the opportunity to give their opinions and answers by promoting multiple-choice questions. Then, Plickers may reduce demotivation because students have to pay attention to respond to questions. A small distraction could prevent a student from answering the question correctly since Plickers questions are supposed to be dynamic and interactive. For this reason, it may become apparent to the instructor who is paying attention to the class when Plickers is used.

Another key feature is the anonymity of the responses. Because Plickers can provide immediate feedback through histograms for the entire class to see, it could generate embarrassment for those students who answered wrongly (BEEKES, 2006, 2009; FIES; MARSHALL, 2006; FREEMAN; BLAYNEY; GINNS, 2006; KAY; LESAGE, 2009). Elliott (2003) reports her case on using SRS in the anonymous mode and perceived that it could be interesting to encourage students' participation without the feeling of being monitored, which is a challenge for student involvement (KAY; LESAGE, 2009). Plickers offers a reasonable level of anonymity that may attract students to use them. Only the instructor can identify who has responded it correctly or otherwise. This is an advantage over the "hands up" method, in which students raise their hands to answer questions. Likewise, anonymity enables instructors to poll students about accounting issues that are not consensual for promoting debate or sensitive and professional ethical questions to capture what students think of them.

Both formative and summative assessments are also vital aspects enabled by SRSs (KAY; LESAGE, 2009), including Plickers. Formative assessment allows the instructor to get real-time information about the students' learning without assigning a formal grade. On the part of the students, formative assessment helps them to analyze their performance on the quizzes and modify bad study habits before taking the exams (EDMONDS; EDMONDS, 2010). For the instructor, getting feedback about the students' understanding enables to implement immediate changes in class pace and the depth of the explanations, increasing the quality of learning (CALDWELL, 2007; KAY; LESAGE, 2009). When it comes to summative assessment, in which Plickers questions are utilized to assign formal grades, Plickers' usage becomes even more important for student attention because now their academic performance is at stake. It encourages more engagement from the students. Likewise, the instructor must equally pay attention to conduct quizzes fairly. It means that he/she must assure that his/her device is working adequately, there is enough time for students to answer, and the questions are aligned with

the educational purposes. When using Plickers for summative assessment, instructors report an increase in student attendance (CALDWELL, 2007). However, Caldwell (2007) points out that if the Plickers questions account for a small part of the total course grade, as such 5%, it might not make students more interested in attending classes. It should account for at least 10% (CALDWELL, 2007).

Despite its benefits, some challenges do deserve thoughts. The main concern is regarding cheating. Like almost any other educational technology tool or teaching method, students can cheat when utilizing Plickers. A common cheating practice among students that one could anticipate is to exchange cards for helping a particular student in enhancing his/her performance. To decrease this undesirable behavior, the instructor should attach the cards' number to a specific student and use it until the end of the academic calendar. Besides, the instructor must evaluate the pros and cons of increasing monitoring policies. Another way to cheat is by looking at the position of a colleague's card. However, Plickers cards' letters (A, B, C, and D) are small (see Figure 1), making it difficult to see. Also, Plickers makes the student audience visual to the instructor, who has the opportunity to identify cheaters while the students are raising their cards. This feature makes Plickers even more relevant for accounting education because business students tend to cheat more than their counterparts (MCCABE, 2005; MCCABE, TREVINO, 1995; RETTINGER, JORDAN, 2005). Despite that, it is recommended that, at the beginning of the classes, faculty talk to students and be clear about cheating practices and their consequences.

Another relevant concern is the maximum number of 63 Plickers cards available. This limitation would not allow an entire class of 70 students, for example, to participate in the Plickers quizzes. When this situation happens, a strategy that can help is to divide the class into groups and, for each group, assign a card. Indeed, it is not appropriate if the instructor wants to evaluate individual performances but represents a way to make every student participate. It also opens an opportunity for students to cheat, like when only one student of the group is paying attention and answering the questions. However, I argue that it is better to form groups and provide chances to every student to use Plickers than excluding some students because of the limited number of cards and give them a legitimate reason to not engage in the class and then complain about their exam performance later.

Instructors who want to use Plickers face the challenges of spending a significant amount of time developing and inserting quizzes in the Plickers software and redesigning their classes to incorporate it while covering the same amount of content. These challenges were also perceived by prior literature for other types of SRS (KAY; LESAGE, 2009; SPRAGUE; DAHL, 2010). The instructors must evaluate if the incorporation of Plickers into classes is viable. It means that it will not make some contents to be put aside because of its implementation. According to Watty et al. (2016), these challenges constitute impediments for accounting educators to use technology because they demand a set of skills and resources that not every instructor has at his/her disposal.

Plickers' benefits and challenges do not end here. However, I provided thoughts on some of the key features that might influence an instructor's decision to adopt it. A valid question that still remains is why should Plickers be adopted instead of other existing versions of SRS. To try to respond to it, I discuss some similarities and differences between Plickers and prior types of SRS in the next section.

## 3. PLICKERS VS. OTHER TYPES OF STUDENT RESPONSE SYSTEMS

I first describe the general characteristics of the previous versions of SRS. Next, I start comparing the Plickers and the other types according to many criteria. Before adopting a specific kind of SRS, comparisons are essential to provide information for educational institutions and instructors to make better decisions.

### 3.1. General features of past SRS versions

Carnaghan et al. (2011) describe three models of SRS: IR-, RF-, and telephony-/web-based SRSs. The IR-based SRS comprehends three parts: (1) A computer attached to a multimedia projector with the SRS software installed in it. Internet access is needless; (2) A hardware receiver – similarly to a wireless router – which captures students' responses through IR signals; and (3) alphanumeric handheld devices that students use to transmit their answers. These devices are similar to a television remote control and are also known as "clickers" (CALDWELL, 2007; RANA; DWIVEDI; AL-KHOWAITER, 2016), because of the sound emitted when someone pushes its button ("click"). The functionality of the IR-based SRS is similar to Plickers. The instructor projects a question; then students have some time to think about it before answering. However, the way by which responses are transmitted and captured differs. IR-based SRSs require a direct line between the receiver and clickers (CALDWELL, 2007); otherwise, the IR signal will not be read. It is similar when people point the remote control to the television to change channels or reduce the volume. This feature imposes two fundamental constraints for IR-based SRS that should be taken into account: (i) they may not be adequate for classrooms with hundreds of students, and (ii) they cannot be employed in distance education. Certainly, these limitations impair the usefulness of the IR-based SRS, but it may still be a relevant pedagogy resources in face-to-face education.

The RF-based SRS has been replacing the IR-based one because it is more modern and has less technical problems (Carnaghan et al., 2011), especially when transmitting student answer. The RF-based SRS also consists of a computer and a projector, a receiver, and alphanumeric handheld devices/clickers. Likewise, it has similar functionality when compared to other types of SRS, but the students' answers are sent and captured through radio frequencies. For this reason,

RF-based SRSs do not demand a direct line between the clickers and the receiver. Carnaghan et al. (2011) report that RF--based SRSs support up to 2000 transmitters and 300 feet distant from the receiver. However, it may vary across SRS providers and models. Nonetheless, RF-based SRS use is appropriate to both small and large classrooms. Still, Eng, Lea, and Cai (2013) highlight that radio frequencies can be set on different channels to avoid interference among multiple classes where RF-based SRSs are being utilized. Despite these benefits, this model cannot be used in distance education as well.

Finally, the web-based SRS is the most recent SRS type created before the launch of Plickers. This type only demands mobile devices, such as smartphones and tablets, with internet access. But it is desirable to have a computer with internet access and attached to a multimedia projector as support. Its functionality differs from other types of SRS because the entire process happens through the internet. First, the instructor exposes a question. Some models of web-based SRS show the question on the screen of each mobile device (e.g., Socrative), but others do not (e.g., Kahoot) and then a projector. Second, students reflect upon the questions and, third, they respond by clicking on the screen of their mobile devices. A weakness of the web-based type is that internet connection is a *sine qua non* condition for quizzes to happen, and not all educational institutions have a good internet signal or enough computer labs for students to use. On the other hand, web-based SRS is the only type that can be employed in distance education, as long as it has internet access. It does not require a direct line or physical proximity between the mobile devices and the SRS software because responses are transmitted via the internet.

### 3.2. Comparative analysis

The first aspect that I compare among the SRS types is how students answer the questions. Plickers uses QR-codes that can be printed and laminated, and the answers can be transmitted with or without internet access to the instructor's device (KRAUSE et al., 2017). If no wi-fi signal or data plan is available, the answers remain stored in the instructor's device until it reaches internet connection. Differently, both IR-based and RF-based SRSs use clickers to transmit responses and a receiver to capture them. No internet connection is needed. On the other hand, web-based SRSs require internet access to work and use mobile devices to respond to questions. Because Plickers need only one mobile device, printed cards, and – desirably – a computer with a projector, it depends less on technology and demands less technical support than the other types of SRS. However, only the web-based SRS can be employed in distance education without significant impediments.

The second aspect that I compare is the response devices' compatibility. In the Plickers type, cards can be exchanged between students from different schools. But IR- and RF-based SRSs require specific alphanumeric tools to work. Each provider has a particular model, and it is not compatible across SRS's providers (CARNAGHAN et al., 2011). For example, iClicker's alphanumeric devices (https://www.iclicker.com) will not work with Poll Everywhere's receiver (https://www.polleverywhere.com). The response devices are not compatible with the receivers of other SRS providers. In the web-based SRS, as long as the mobile device has access to the internet, it will work with quizzes from distinct SRS software/websites. However, old cell phone models may not be compatible with more modern web-based SRSs. Because of that, I recommend the smartphone model.

Third, because cards, clickers, and cell phones are small, they are easy to be lost or forgotten (DALLAIRE, 2011). For instance, Dallaire (2011) surveyed 151 psychology students and found that 57% of them declared that forgetting to bring the clickers to class is the main obstacle to use the SRS. Therefore, instructors need to establish a "bring your own device" (BYOD) policy. BYOD policy may help students to avoid forgetting the response devices that would otherwise prevent them from participating in class. BYOD might be necessary for Plickers cards if they were lent to students. But the instructor can distribute the cards to students at the beginning of each class, and at its end, the students give the cards back. Arguably, alphanumeric devices can be lent by the instructor and returned as well (CALDWELL, 2007); however, this is not valid for the web-based SRS since no student would be willing to let the instructor keeps his/her device. Thus, BYOD is even more necessary for the web-based SRS.

Fourth, the data that is produced by Plickers is not massive. Access to wi-fi signal or a mobile data plan should be sufficient to send the students answers to the cloud. However, in some other SRS models, the files may contain more graphics and different types of pictures to provide the instructor and students better feedback. Colors and images make files heavier, but the files' sizes also depend on the number of students, the number of questions, how many times the SRS was used, and so on. Indeed, as time passes, the instructor will have taught more classes and storing all the data generated by the SRS may become a concern, primarily if he/she teaches hundreds of students a year. But at least it should not be a concern for Plickers files since it can capture 63 responses per time.

Fifth, Plickers have a disadvantage when it comes to response time. It does not keep any records on how much time the students took to answer the questions mainly because it depends on where the instructor points his/her device first. So, even if a student raises his/her card first, his/her card may not be the first to be scanned. Similarly, in other types of SRS, the answers may suffer a delay depending on how strong the internet connection is or how accurate the devices are.

Sixth, financial issues represent a relevant threat to educational technology because they may impair its usability and in many times are decisive factors to use it. In an era where educational institutions' budgets have strong constraints, research on low-cost educational resources associated with effective outcomes becomes even more fundamental. Plickers consists of QR-code cards and a mobile device to scan them. Plickers software/app is free. Then, the cost of Plickers is minimum, especially when different classes are using all the cards over a significant period.

One of the chief complaints about the IR- and RF-based SRSs is the cost of the clickers and it definitely represents a barrier to their use (BAILEY, SCOTT; HYDE, 2010; CALDWELL, 2007; CARNAGHAN et al., 2011; JONES, HENDERSON; SEALOVER, 2009; KAY; LESAGE, 2009; RANA et al., 2016; ZHU, 2007). These SRS types require alphanumeric devices which purchase depends on the policy established by the educational institutions. Some institutions (e.g., West Virginia University) buy the clickers and lend them to the students (CALDWELL, 2007; MULA; KAVANAGH, 2009), but others demand students to purchase their own. Clicker's acquisition by students is likely to affect their acceptance and satisfaction with technology (DALLAIRE, 2011). Therefore, instructors have to ensure that clickers will be used regularly. Otherwise, students may not see value in them, which would lead to a perception of a waste of financial resource (ZHU, 2007). Despite the recent decrease in the clickers' price, it can still be a significant investment for educational institutions or students (BLASCO-ARCAS; BUIL; HERNÁNDEZ-ORTEGA; SESE, 2013; RANA et al., 2016). Carnaghan et al. (2011) and Zhu (2007) provide some recommendations for saving money.

Web-based SRSs do not demand any purchase of clickers as they use students' own mobile devices. On the other hand, some web-based SRS developers/providers may require a registration fee to allow students to utilize their web system. For instance, iClicker has multiple types of subscription (https://www.iclicker.com/pricing), varying in value and period. However, there are free web-based SRSs as well. Kahoot! (https://kahoot.com) is a free SRS – although it also has paid subscriptions – and represents a better option for educational institutions or teachers which budget is limited. Free web-based SRSs have a financial cost near zero because they basically need an internet connection. In IR- and RF-based SRSs this is not necessarily true, because each of the clickers has an individual price (e.g., iClicker go charges about 30 USD per unit) that exceeds the cost of printed cards. Thus, from a financial standpoint, Plickers and web-based SRS are alike and have an advantage over the IR- and RF-based SRS types.

Finally, a final aspect that I highlight is that clickers' and cell phones' batteries should be charged. It will be a serious concern if some clickers stop working in the middle of the SRS quizzes, especially if the instructor is using SRS questions to attribute course grade. Although this seems less relevant, instructors and students must pay attention to this detail. When Plickers is employed, though, no battery is needed, except for the instructor's device.

After comparing essential factors for using each type of SRS, I provide a summary of the comparisons made among them in Table 1.

**Table 1 – Summary of the comparative analysis among the SRS types**

| Type of SRS | Plickers | IR-based SRS | RF-based SRS | Web-based SRS |
|---|---|---|---|---|
| Response device | QR-code card | Clicker | Clicker | Mobile device |
| Response transmition | Internet/Scan | Infrared signal | Radio frequency | Internet |
| Internet/Wi-fi signal | Yes (1 device)/No [A] | No | No | Yes |
| Dependency on technology | Medium | High | High | High |
| Technical support | Dispensable | Sometimes | Sometimes | Sometimes |
| Device's compatibility across providers | Yes | No | No | Yes |
| BYOD policy | Yes/No [B] | Yes/No [B] | Yes/No [B] | Yes |
| Battery | Yes (1 device)/No | No | No | Yes |
| File size | Not heavy | Not heavy | Not heavy | Not heavy |
| Distance education | No | No | No | Yes |
| Small classrooms | Adequate | Adequate | Adequate | Adequate |
| Medium classrooms | Adequate | Adequate | Adequate | Adequate |
| Large classrooms | Not adequate | Adequate/Not adequate [C] | Adequate | Adequate |
| Clicker purchase | No need | Need | Need | No need |
| Free software | Yes | No | No | Yes/No [D] |

*Note.* [A] It depends on whether the instructor wants to use plicker in online or offline mode. [B] If students purchase the clickers, BYOD is necessary; otherwise, it is unnecessary. If cards are lent to students, BYOD is necessary. [C] It depends on how students' seats are organized. [D] It depends on the SRS provider.

## 4. ACTIVE LEARNING AND STUDENT RESPONSE SYSTEMS

Active learning is frequently characterized as the usage of instructional methods that actively engage students in the learning process, opposing the traditional education (GAINOR, BLINE; ZHENG, 2014; SULLIVAN, 2009). Although this term has been used more intuitively than consensually (BONWELL; EISON, 1991), a key point is the predominance of a perspective that promotes changes in the conventional ways of transmitting content, such as a unilateral communication.

Active learning has been providing theoretical support for using SRS because its idea is associated with many of the SRS's features. For instance, evidence from prior literature supports that SRS encourages higher student involvement in classes (CARNAGHAN; WEBB, 2007; EDMONDS; EDMONDS, 2008; ENG et al., 2013; KAY; LESAGE, 2009; LEA, 2008). It suggests that SRSs can combat passive learning, traditional teaching methods, and dull classroom environments that new generations of students complain about. And this may be valid for Plickers as well, although more research is still demanded.

In active learning, the center of the educational process is the student, instead of the instructor. When Plickers is used, students must pay more attention to the lecture and the questions to get them right. As previously discussed, a few seconds are provided for students to respond to the questions. It is on purpose, aiming to foster a dynamic environment where students must keep their attention and involvement at high levels.

Because SRS allows every student to participate in class, they may feel that the instructor values their opinion. In Zhu (2007) words:

> Students' responses, and their questions about their peers' responses, can provide an opening for class discussion. When students recognize their own opinions and co-direct a class discussion, they may feel a greater sense of ownership over the lecture and discussion. As a result, they will be more engaged in and responsible for their own learning. Also, instead of drawing conclusions from the most vocal students, the faculty member receives a far more accurate overview of opinions from the entire class. Most important, the anonymous feature of the clicker system ensures that viewpoints that might not otherwise be expressed during class discussion are given a voice (Zhu, 2007, p. 2)

This excerpt is aligned with active learning strategies, in which the students are more responsible for their learning. Bonwell and Eison (1991) argue that a crucial aspect of active learning is not only to learn the content that is being taught, but also to reflect on what was learned. Plickers and other types of SRS can be used to make students think about their learning by providing feedback regularly. If students maintain their performance records on quizzes, they can modify their behavior to reach their academic goals.

According to Gainor et al. (2014), current accounting students tend to prefer engaging learning processes with rapid development rather than those that are passive. Literature reviews on SRS show that this technology can promote higher student attention, involvement, interactivity among colleagues, and participation in classes (FIES; MARSHALL, 2006; KAY; LESAGE, 2009; RANA et al., 2016). These results are consistent with the expectations of the new generations of students, as well as the active learning idea. Based on this discussion, I argue that Plickers can promote a more active learning environment and provide richer academic experiences that students search for in educational processes.

## 5. PREVIOUS RESEARCH ON PLICKERS

In December 2017 and January 2018, I reviewed 37 Brazilian business journals (for the complete list, see Appendix A) and six international accounting education journals (1. Accounting Education, 2. Advances in Accounting Education, 3. Journal of Accounting Education, 4. Global Perspectives in Accounting Education, 5. Accounting Educators' Journal, and 6. Issues in Accounting Education) to identify studies on Plickers. I inserted "plicker" and "plickers" as keywords in the search tool of the journals. I was not able to find any study. Then, I conducted an additional search in Google Scholar using the same keywords and also "plickers and accounting education." I analyzed the first ten pages of the results (each page contained ten results) of each keyword. I found only a few studies published in journals, which suggest that Plickers has not been examined even in other knowledge fields. The studies found are now described.

Thomas et al. (2016) analyzed the relationship between knowledge, participation, and creativity when Plickers is used. A sample of 60 high school students was submitted to the analysis. Pearson's correlation matrix showed a positive association between creativity and participation (coeff. = .369; $p < .01$). It suggests that Plickers helps students to become more creative through participation. Thomas et al. (2016) also found a positive correlation between participation and knowledge (coeff. = .903; $p < .01$). It indicates that Plickers assists students to participate in class, and then knowledge is improved. Another potential explanation is that Plickers supports students to gain knowledge, and then they feel more comfortable to participate. These findings suggest that Plickers have a positive impact on students' participation and related aspects. However, the results should be observed with caution since they are based on the students' perception, are correlational, and were produced from a small sample. Then, Carnaghan and Webb (2007) suggest that studies should find ways to measure the variables objectively rather than using self-reporting measures. It may help to analyze data from a more neutral perspective.

Wood, Brown, and Grayson (2017) investigated the faculty's and students' perception of the use of Plickers. From the faculty's perspective, Plickers modified the classroom mood, especially in the first session. It promoted fast-paced

and exciting activities. Besides, Plickers encouraged students to assume an interactive and heads up posture toward the instructor. However, responses are typically deficient in the first quizzes (WOOD et al., 2017). I emphasize that the faculty's perspective should be analyzed cautiously and critically since no data was reported in the study. From the students' perspective, it was found that Plickers sharply increased students' involvement (63%) and learning (66%). Beckert, Fauth, and Olsen (2009), Eng, Lea, and Cai (2013), Lea (2008), and Yourstone, Kraye, Albaum (2008) also found an improvement on students' participation and involvement, but they tested clickers instead. Complementarily, 60% of the students would recommend Plickers for other instructors to employ it in their classes. This is consistent with Beckert, Fauth, and Olsen's (2009), Premuroso, Tong, and Beed's (2011), and Stowell's (2015) results. However, it seems that Plickers has a little impact on previous preparation for class (62% of the students reported that Plickers slightly encouraged preparation prior to classes). Despite that, 83% of the students preferred Plickers over paper quizzes, and 60% preferred Plickers over clickers. However, only 9% preferred Plickers over other quiz methods. These findings support that Plickers is an attractive alternative pedagogy comparatively to different types of SRS.

Wuttiprom et al. (2017) analyzed the Plickers usage in conjunction with peer instruction (PI) at the Ratchathani University, Thailand. The first-year undergraduate students of Chemistry (n = 50) and Engineering (n = 119) constituted the sample of the study. Results showed that students' average scores improved after PI for both Chemistry and Engineering students. It suggests that Plickers is an adequate educational resource to mediate the relationship between students' performance and PI. This result is congruent with Marshall and Varnon's (2012). Students also reported that Plickers make class more fun and enjoyable, in agreement with other studies (CARNAGHAN et al., 2011; CARNAGHAN; WEBB, 2007; CHATHAM; DAVIDSON, 2011; CUNNINGHAM, 2008, 2011; EDMONDS; EDMONDS, 2008; ENG et al., 2013; LEA, 2008; MARSHALL; VARNON, 2012; MULA; KAVANAGH, 2009; PREMUROSO et al., 2011). At this point, both clicker and Plickers research show convergent evidence.

McCargo (2017) examined the effects of Plickers on academic engagement behavior of high school students through an experimental procedure. The results indicated that Plickers usage is not associated with students' disruptive behavior. McCargo (2017) also investigated the perception of high school teachers in terms of the "use of Plickers® as a socially valid method for addressing student behavior." (p. 47). Mixed results to support Plickers as a valid method were found, but the chief complaint was the time spent to prepare the Plickers activity. This is consistent with prior SRS literature as well (CARNAGHAN et al., 2011; KAY; LESAGE, 2009; SPRAGUE; DAHL, 2010), even though Howell et al. 2017, p. 145) report that "it is easy to add class sections, students rosters, and MCQs to the Web site."

Krause, O'Neil, and Dauenhauer (2017) investigated Plickers as a formative assessment tool for K-12 and physical education teacher education (PETE) professionals. The study is a descriptive one that provides some considerations on the usage of Plickers in K-12 physical education. Particularly, Krause et al. (2017) provide examples of how Plickers can be employed to develop four domains of learning: psychomotor, cognitive, affective, and general. Regarding Plickers usage in PETE programs, an important observation is that the use of Plickers "is a great way to get PETE students involved in both the technology and assessment processes" (KRAUSE et al., 2017, p. 36). It might be extended to other training programs.

According to my search, I was not able to find any published article in accounting academic journals about Plickers so far. The majority of the literature is concentrated on prior versions of SRS (BEEKES, 2006, 2009; CARNAGHAN et al., 2011; CARNAGHAN; WEBB, 2007; CHATHAM; DAVIDSON, 2011; CHUI, MARTIN; PIKE, 2013; CUNNINGHAM, 2008, 2011; EDMONDS; EDMONDS, 2008, 2010; ENG et al., 2013; MARSHALL; VARNON, 2012; MULA; KAVANAGH, 2009; SEGOVIA, 2006, 2008). Thus, Plickers is a timely research topic.

## 6. FINAL THOUGHTS

This study aimed to offer a reflection on Plickers as an alternative pedagogy approach for accounting educators to use. According to my literature review, Plickers has not been considered as a topic by accounting researchers as no published work was found. It means that relevant discussions and research are convenient in the sense of increasing our understanding of Plickers and how it can assist both accounting students and faculty in having a more fluent educational process.

To show the value of Plickers, I base my thoughts on three arguments. First, Plickers can be used with or without an internet connection (KRAUSE et al., 2017) and are less dependent on technology than other types of SRS. Therefore, it is easier to make them work. Second, Plickers has an advantage over other types of SRS in terms of financial cost. It is generally cheaper than IR-based and RF-based SRSs as no clicker needs to be purchased. It is similar to the web-based SRSs, but some of them do require a subscription fee (e.g., iClicker) that might be relevant. Third, even though Plickers cannot be employed in distance education or would be inappropriate for large classrooms, they have similar potential benefits that clickers offer. Plickers helps students to participate and get more involved in classes (THOMAS et al., 2016; WOOD et al., 2017), as well as serve to mediate student learning and other teaching methods (WUTTIPROM et al., 2017). Plickers is also flexible regarding its utilization in different levels of education, as Krause et al. (2017) showed.

Regarding implications for practice, preliminary findings on the use of Plickers suggest that it increases students' performance when utilized with PI (WUTTIPROM et al., 2017). Student involvement and learning were also found to be enhanced (WOOD et al., 2017). However, weaker evidence supports that Plickers encourages students to prepare them-

selves for classes. Based on these findings, accounting instructors can use Plickers to generate more student involvement in face-to-face education. These results are consistent with clicker studies, but Plickers would be equally important to use because they are less dependent on technology and has lower financial costs than prior versions of SRS. On the other hand, if compared to web-based SRS, Plickers could not be employed in distance education. It might reduce Plickers' usefulness, but it can still be a useful pedagogy tool inside the classroom.

For future studies, I recommend the analysis of the mediated effects of Plickers on the relationship between students and teaching methods. Wuttiprom et al. (2017), for instance, utilized Plickers with PI. Marshall and Varnon (2012) conducted a similar study with clickers and PI. Other teaching methods can be assisted by Plickers, such as think-pair--share or problem-based learning. Plickers can be utilized in multiple ways, and the observation of how they mediate learning and teaching methods is vital to deliver content effectively. Another relevant analysis is regarding the quality of Plickers utilization. Experimental studies on SRS have been conducted (CARNAGHAN; WEBB, 2007; CHUI et al., 2013; EDMONDS; EDMONDS, 2008), measuring the use of SRS in a binary way (usually 1 for SRS and 0 for No SRS). However, little attention is paid to the discussion about the *quality* of the SRS usage. Some questions emerge from this context: for how long should SRS be used over a semester? Is there an optimum length for SRS quizzes to last? Is binary measurement the best proxy to be used or there are degrees of quality of SRS usage? Thus, an in-depth discussion about SRS utilization remains missing. Therefore, I encourage discussions on quality of Plickers use.

Ultimately, I hope that I have provided some insights for accounting educators' decisions to utilize Plickers as an alternative pedagogy resource to the existing response systems and teaching methods. I am favorable about using Plickers because of its potential benefits to both faculty and students, besides the low cost it involves, but I acknowledge that limitations and challenges do exist and should be considered when adopting this technology.

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## FINAL NOTE:

I declare no conflict of interest with SRS's developers/providers.

## APPENDIX A – List of Brazilian Journals that were reviewed

| Number | Journal | Institution/Sponsor |
|---|---|---|
| 1 | *Advances in Scientific and Applied Accounting* | ANPCONT |
| 2 | *Brazilian Business Review* | FUCAPE/ES |
| 3 | Revista Contabilidade & Finanças | FEA/USP |
| 4 | Base | UNISINOS/RS |
| 5 | Contabidade Vista & Revista | UFMG/MG |
| 6 | Custos e @gronegócio *online* | UFRPE |
| 7 | Revista Brasileira de Gestão de Negócios | FECAP/SP |
| 8 | Revista Contemporânea de Contabilidade | UFSC/SC |
| 9 | Revista de Contabilidade e Organizações | FEARP/USP |
| 10 | Revista Mineira de Contabilidade | CRC-MG |
| 11 | Revista Universo Contábil | FURB/SC |
| 12 | Contabilidade Gestão e Governança | UnB |
| 13 | Revista de Administração, Contabilidade e Economia | UNOESC/SC |

| Number | Journal | Institution/Sponsor |
|---|---|---|
| 14 | Revista Ambiente Contábil | UFRN |
| 15 | Revista de Educação e Pesquisa em Contabilidade | Abracicon/DF |
| 16 | Revista Enfoque: Reflexão Contábil | UEM/PR |
| 17 | Sociedade, Contabilidade e Gestão | PPGCC/UFRJ |
| 18 | ConTexto | UFRGS |
| 19 | Pensar Contábil | CRC/RJ |
| 20 | Revista de Administração, Contabilidade e Economia da FUNDACE | FUNDACE |
| 21 | Revista de Contabilidade e Controladoria | UFPR/PR |
| 22 | Registro Contábil | UFAL |
| 23 | Revista de Contabilidade do Mestrado em Ciências Contábeis | UERJ/RJ |
| 24 | Revista de Gestão, Finanças e Contabilidade | UNEB |
| 25 | Revista de Informação Contábil | UFPE/PE |
| 26 | Revista do Instituto de Ciências Econômicas, Administrativas e Contábeis | FURG/RS |
| 27 | Revista da Associação Brasileira de Custos | Associação Brasileira de Custos |
| 28 | Revista de Administração, Contabilidade e Sustentabilidade | UFCG - CCJS/UACC |
| 29 | Revista Catarinense da Ciência Contábil | CRC/SC |
| 30 | Revista de Contabilidade da UFBA | UFBA/BA |
| 31 | Revista de Estudos Contábeis | UEL/PR |
| 32 | *CAP Accounting and Management* | UTFPR |
| 33 | Revista Brasileira de Contabilidade | CFC |
| 34 | Revista de Administração e Contabilidade da FAT | Faculdade Anísio Teixeira |
| 35 | Revista de Gestão e Contabilidade da UFPI | UFPI |
| 36 | Revista Evidenciação Contábil | UFPB |
| 37 | Práticas em Contabilidade e Gestão | Mackenzie |