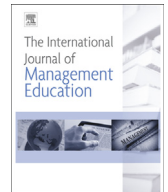


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Research notes

A review of literature on the use of clickers in the business and management discipline

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ABSTRACT

Classroom response systems (clickers), in their various forms, are widely used across disciplines, demonstrating effectiveness across a range of different educational settings. However, only a few literature reviews on this technology have been undertaken in general, and no review has yet been performed on this topic in the business and management context. Realising the existing research gap, this article reviews 33 clicker-related studies from the business and management discipline that are largely focused on student perceptions and outcomes. The purpose of this paper is to provide a critical and balanced review of articles from the business and management discipline on various themes such as learner's engagement, performance, learning, participation, satisfaction, feedback, attendance, enjoyability, motivation, and interactivity, to name a few. The review also provides a brief account of lessons learned from the literature published in other disciplines and recommendations provided by studies from the business and management discipline.

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1. Introduction

Information technology (IT) has been recently considered as a strategic resource in educational settings, providing educational institutions with a distinctive opportunity to enhance student motivation and improve learning outcomes (Blasco-Arcas, Buil, Hernandez-Ortega, & Sese, 2013; Roblyer & Wiencke, 2003). To continue to maintain class interest, focus, and motivation, today's students expect more visually motivating material and integration of technology into their lessons (Smart, Kelley, & Conant, 1999). Studies have demonstrated that active involvement can bring in-depth understanding and greater knowledge retention while motivating higher intellectual processes and critical thinking skills (Conrad & Donaldson, 2004; Mareno, Bremner, & Emerson, 2010). Therefore, mastering the art of engaging students in the learning is indispensable to successful learning outcomes. Clickers, also known as classroom response system (CRS), audience response system (ARS), personal response system (PRS), group response system (GRS), or student response system (SRS), are broadly used across university courses for a number of reasons but largely for creating an active learning environment (Bruff, 2009; Carnaghan & Webb, 2007).

The use of clickers in the classroom has gained popularity in the academic environment over the past few years (Bonaïuti, Calvani, & Piazza, 2015; Carnaghan & Webb, 2007; HatziaPOSTOLOU, Pupovci, Dranidis, Paraskakis, & Ntika, 2014; Lai, Hill, &

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Ma, 2015; Lojo, 2009; Mula & Kavanagh, 2009). Most of the early clicker research has been undertaken in the context of the health/medical professions and natural sciences as these disciplines were the early adopters of clicker technology. However, studies on clicker use have started to appear in a number of other academic disciplines. The increasing interest in clicker technology by the researchers is largely due to the services provided by clicker usage including instant and anonymous feedback of student understanding (Barnett, 2006; Crossgrove & Curran, 2008; De Gagne, 2011; Lincoln, 2008; MacArthur & Jones, 2008), improvements in student performance (Caldwell, 2007; Ueltschy, 2001), attendance (Caldwell, 2007; Koenig, 2010; Lincoln, 2008), attention (Crossgrove & Curran, 2008; Lincoln, 2008; Prather & Brissenden, 2009), and participation (Addison, Wright, & Milner, 2009; Rana & Dwivedi, 2015; Salemi, 2009; Sprague & Dahl, 2010). However, clickers are not beyond certain drawbacks, including difficulty in designing effective clicker questions related to critical thinking, which are focused on synthesis, evaluation, and analysis (Herreid, 2006), cost (Barnett, 2006; Blasco-Arcas et al., 2013; Herreid, 2006; Kay & LeSage, 2009; Strasser, 2010), technical glitches in the devices (i.e., inoperable clickers) (Barnett, 2006; Blasco-Arcas et al., 2013; Herreid, 2006; Kay & LeSage, 2009; Koenig, 2010), additional preparation time required by the instructor (Koenig, 2010), interrupted flow of lectures (Koenig, 2010; Strasser, 2010), etc.

The benefits (such as immediate feedback, improved interaction with the instructor, supporting anonymity for critical and sensitive questions) and certain barriers or challenges (such as cost, clicker-enabled course material preparation time, encouraging only implicit participation) provided by clickers in the classroom learning environments have been documented for some disciplines (e.g., nursing, medical, pharmacy, paramedical, etc.). However, acceptance and use of clickers in other disciplines, particularly in business and management, has not been much considered in the literature yet (Keough, 2012). Therefore, this study provides a review of existing literature on clicker use from the business and management perspective and synthesises findings to understand the overall knowledge in this area.

2. What are clickers? key advantages and disadvantages

Clickers are small receivers that look similar to a television remote control. They are sophisticated technological devices that allow students to rapidly answer questions in the class. An infrared or radio frequency receiver and software on the instructor's computer captures students' responses. The computer software records responses and collates them into a database. Students are presented with a question through a PowerPoint slide, with a range of answers, which are designated with a number or letter. Respondents then key the number or letter correlating to their answer, which through the receiver is composed and then organised. Response can be anonymous or linked to specific students through the clickers' unique IDs, allowing the instructor to know students' responses to analyze their attendance or to know who gave correct or incorrect responses (Blasco-Arcas et al., 2013; Mula & Kavanagh, 2009; Stagg & Lane, 2010). They are also known in their different forms including ARS (Guthrie & Carlin, 2004), CRS (Nelson & Hauck, 2008), Electronic Response System (ERS) (Robinson, 2007), GRS (Carnaghan & Webb, 2007), PRS (Humphries & Whelan, 2009; Matesic & Adams, 2008), and SRS (Bain & Przybyla, 2009) across different studies.

The literature suggests that clickers deliver significant advantages to both instructors and students (Bergtrom, 2006; Blasco-Arcas et al., 2013; Bullock et al., 2002; Simpson & Oliver, 2007). They provide instructors with immediate feedback on students' responses. They are useful to students in terms of improving their engagement, participation, performance, learning, satisfaction, motivation, understanding, interaction, etc. in the class (Blasco-Arcas et al., 2013; Caldwell, 2007). Despite these benefits of clickers, some disadvantages should also be noted. Although the cost of this technology has reduced in recent years, it is still significantly high for some educational institutions. This well may be a barrier for some educational institutions to adopting and integrating them in their learning process. Also, due to their occasional technical glitches, bugs, and failures, they may be annoying and unsatisfying to use at times (Blasco-Arcas et al., 2013; Kay & LeSage, 2009). Further, the instructor needs to devote a lot of time to designing clicker quizzes. These are not only difficult to compose but also need to be designed in a way that can really test students' understanding on the related subject matter (Strasser, 2010). Clickers were also criticised for interrupting the flow of the lecture and taking up a greater amount of class time (Koenig, 2010; Strasser, 2010). Herreid (2006) argued that clickers are specifically efficient for deriving responses to questions at the lower levels of Bloom (1956)'s taxonomy, where questions concerning facts such as remembering and understanding are involved. However, when it comes to the highest level of Bloom (1956)'s taxonomy (i.e., questions related to critical thinking, which is focused more on synthesis, evaluation, and analysis), designing effective questions needs significant creativity and time.

3. Research methodology

We employed a systematic review to classify, gather, and analyze relevant literature on clicker technology using keywords such as *clickers*, *turning point*, *audience response system*, *personal response system*, and *classroom response system* in 29 appropriate and related journals on education [see Appendix [A] for the list of journals]. However, we could get access to only eight articles (out of a total of 72 articles from all disciplines) on various streams of business and management including *accounting*, *marketing*, *finance*, *business statistics*, *operations management*, *industrial management*, and *management information systems*. Realising the number to be relatively few, we intended to search for the relevant articles from Google Scholar using phrases such as *clickers in* ("*business*", "*management*", "*accounting*", "*finance*", "*management information systems*", and "*marketing*") every time with a quoted keyword. Using this approach, we found 25 articles on the use of clickers in various

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