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Investigating Student Perceptions and Behavioral Intention to Use Multimedia Teaching Methods for the SAP ERP System

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Abstract

ERP systems have a reputation for their complexity, making it challenging for students to learn to use them. This study uses three common multimedia teaching methods, including the lecture, the video-based tutorial, and the paper-based tutorial to deliver hands-on SAP ERP exercises to students. Studies show that multimedia learning helps learners process complex information and foster deeper learning. This study aims to understand how students perceive the multimedia teaching methods for learning the SAP ERP system. The technology acceptance model (TAM) is used to capture students' perceptions and intention to use each teaching method. The study found that perceived ease of use (PEOU) played a stronger influence on intention to use than perceived usefulness (PU) across the multimedia teaching methods. However, the PU of video-based tutorials showed a stronger influence on intention to use than the lectures and the paper-based tutorial. This study suggests that the video-based tutorial is suitable for an SAP ERP exercise with complex operating sequences and underlying business aspects. The lecture is suitable for a short SAP ERP exercise with simple operating sequences and underlying business concepts. The paper-based tutorial is an effective method when it is used for a short and straightforward SAP ERP exercise.

Key words: *ERP learning challenges; SAP; TAM; Multimedia Teaching Methods; Video-based tutorial, Paper-based tutorial.*

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Introduction

Over the past 50 years, Enterprise Resource Planning (ERP) systems have been widely implemented across industries. The global ERP system market was estimated at $94.71 billion in 2020 and expected to reach $97.15 billion in 2024 (Pang et al., 2020). Davenport (1998, p. 122) noted that the adoption of ERP systems by the corporate world is considered "the most important development in the corporate use of information technology in the 1990s." IDC Learning Services Research reported that organizations spent 15% of their total ERP budgets on training (Purr, 2020), indicating that ERP training played a critical role in the success of ERP implementation and ongoing operations. Research also shows that employee training positively influences ERP implementation and project success (Garg and Garg, 2013; Amoako-Gyampah & Salam, 2003; Zabukovsek et al., 2019; Bueno & Salmeron, 2008; Costa et al., 2020; Marler et al., 2006). However, the ERP systems are large and complex (Ceaparu et al., 2004). The complexity of ERP systems means that an organization needs employees with knowledge and skills of ERP systems.

In response to market demand for ERP-knowledge workers, ERP software vendors, such as SAP and Oracle, provide academic programs to encourage institutions to produce college students with the ERP skills demanded by corporations. (Hustad & Olsen, 2011; Seethamraju, 2007; Surendran et al., 2006; Scholtz et al., 2013). An example of the ERP education programs is the University Alliance, a collaboration between SAP, a leading ERP vendor, and higher education institutions. The University Alliances offers various SAP ERP training subjects for instructors to transfer SAP ERP knowledge and skills to students. Despite the knowledge transferred from ERP vendors, instructors found it challenging to teach ERP systems to college students learning to use the ERP systems for the first time (Laosethakul et al., 2016). Studies showed users found ERP systems challenging to learn to use due to their technological complexity (Topi et al., 2005; Matthews, 2008; Scholtz et al., 2013). One crucial question arises on the ERP learning challenge: what would be a teaching solution that could help students overcome the ERP learning challenge? One possible solution may be found in in multimedia learning, which helps learners process complex information and achieve deeper learning (Mayer, 2003).

This study uses three common multimedia teaching methods, including 'the lecture' (the instructor-led classroom lecture/demonstration), the video-based tutorial, and the paper-based tutorial to deliver hands-on SAP ERP exercises. This study aims to investigate (1) students' perceptions of and intention to use these multimedia teaching methods for learning the SAP ERP systems in the future and (2) the differences of these perceptions and intention to use among these multimedia teaching methods. Understanding students' perceptions of multimedia teaching methods will allow instructors to improve the methods and use them more effectively.

The following section discusses the ERP learning challenge and follows by a discussion on multimedia learning and three multimedia-teaching methods, including the lecture, the video-based tutorial, and the paper-based tutorial. Then, the technology acceptance model and how it is suitable to measure students' perceptions of and intention to use the multimedia teaching methods for the ERP systems is explained. Lastly, the research methodology and research findings is explained and discussed.

ERP Learning Challenge

The Enterprise Resource Planning (ERP) is complex software that integrates all business functions throughout an organization into a single system with a central database (Baltzan, 2018, p. 235). The single system with integrated business functions enables business processes and information to be streamlined across the organization, which allows employees to do their jobs more efficiently. The central database collects

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information from and feeds information into all the ERP system's application components that support a variety of business functions (Baltzan, 2018, p. 236). The complexity of ERP systems lies within many integrated business functions and their associated business processes; in addition, an ERP system serves cross-functional business processes (Baltzan, 2018). Despite vendor support, the complexity of ERP systems presents a challenge to inexperienced college students (Rosemann & Watson, 2002; Holub & Bruckner, 2016).

According to Ceaparu et al. (2004), the ERP systems have always been known for their technological complexity arising from the fact that ERP integrated various business functions and disciplines into one system and processed a large amount of data. Due to this technological complexity, students reported learning difficulties when using the ERP systems (Theling & Loos, 2005; Seethamraju, 2007) and rated them poorly regarding ease of use of the ERP systems (Surendran et al., 2006). The ERP systems' technological complexity resided in their user interfaces, which were reported to have poor usability (Yeh, 2006; Singh & Weston, 2009; Khoury et al., 2012). Topi et al. (2005) noted that the poor usability caused users to have difficult interaction with the ERP systems, thereby making it challenging to complete required tasks. Students reported spending a significant amount of time learning details of all the screens, menu paths, and functions (Shtub, 2001; Theling & Loos, 2005); this process forced students to focus on completing the assigned task rather than understanding the underlying business processes (Wang et al., 2009; Winkelmann & Leyh, 2010; Seethamraju, 2008). Seethamraju (2007) found that students improved their ERP transactional competencies but struggled to understand the underlying business aspects. Some students described their ERP experience as a routine data entry exercise without deeper learning opportunities. Laosethakul et al. (2017) found that students performed better on an SAP ERP test's technical aspect than a business concept aspect. Seethamraju (2008) explained that the complexity of the ERP systems made it difficult for students to connect information, business processes, and managerial decisions.

Although existing studies found that training positively influenced ERP implementation and project success, suggestions and guidelines for instructors to help students overcome these challenging issues were limited. For instance, Zabukovsek et al. (2019) suggested that it was essential that teachers prepare excellent teaching materials explaining the ERP topics with simple operating sequences. Marler et al. (2006) noted that employees needed to have extensive training involving multiple training modules that demonstrated different functionalities of the ERP systems. Bueno and Salmeron (2008) recommended that organizations could use training to reduce the perception of ERP systems' complexity. Thus, there is a great need for a study that provides instructors with guidelines for helping students overcome the ERP learning challenges caused by the technological complexity. This study uses the concept of multimedia learning in designing hands-on SAP ERP exercises. Multimedia learning has been known to help learners process complex information and achieve deeper learning through words and pictures (Mayer, 2003; Mayer & Moreno, 2003). The following section discusses multimedia learning and three common multimedia teaching methods, including the lecture, the video-based tutorial, and the paper-based tutorial.

Deeper Learning through Multimedia Teaching Methods

According to the cognitive load theory, when learners have difficulty integrating a large amount of complex information due to a lack of knowledge background, their cognitive processing is overloaded (Kalyuga, 2009). This difficulty can cause motivational frustration and less effective learning (Merrill et al., 1992). A solution to the ERP learning challenges may lie within multimedia learning. Research showed that multimedia learning helps students process information complexity and achieve deeper learning (Mayer, 2003). Mayer and Moreno (2003, p. 43) defined multimedia learning as "learning from words and pictures" and multimedia instruction as "presenting words and pictures that are intended to foster learning." The words could be printed text or

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spoken narration. The pictures could be illustrations, graphs, photos, screenshots, videos, and animation. A principle of multimedia learning theory states, "people learn more deeply from words and pictures than from words alone" (Mayer, 2005, p. 31). The multimedia learning theory is derived from three assumptions based on cognitive science principles. First, humans process information through visual/pictorial (eyes) and auditory/verbal (ears) channels. Second, each channel has a limited capacity to process information. Third, meaningful learning involves carrying out a coordinated set of the cognitive processes, including selecting and filtering the presented material, organizing the presented material into a coherent structure, and integrating the presented material with existing knowledge. According to these assumptions, people can learn more deeply from words and pictures than words alone. Mayer and Moreno (2003) explained further that it is essential to understand how our cognitive system processes information and then design multimedia instruction accordingly. When multimedia instruction is designed to be compatible with how the human mind processes information, learning is likely to be meaningful (Mayer, 2003). Mayer and Moreno (2003, p. 43) defined meaningful learning as a "deep understanding of the material, which includes attending to important aspects of the presented material, mentally organizing it into a coherent cognitive structure, and integrating it with relevant existing knowledge."

Mayer (2009) developed principles of multimedia instruction to guide educators in developing meaningful multimedia instructions. The goal of Mayer's multimedia instructional design principles was to manage essential processing, reduce extraneous processing, and foster generative processing to avoid cognitive overload. This study follows Mayer's (2009) principles of multimedia instruction when designing hands-on SAP ERP exercises. The following section discusses the concept of multimedia teaching.

Multimedia Teaching Method

College graduates hired by organizations using the ERP systems would likely be trained through various ERP training methods. Michael Management Corporation (MMC) conducted an industrial survey with more than 1000 SAP ERP professionals and found that they used a variety of ERP learning methods (Perino & Michael, 2013). The instructor-led training, whether it was a classroom or a virtual format, accounted for approximately 38 percent of all ERP training methods. The self-study e-learning methods accounted for 27 percent. The survey did not reveal the types of self-study e-learning methods; however, according to Van der Meij & Van der Meij (2014), the two most common self-studying methods for software learning/training include the video-based tutorial and the text-based tutorial. Based on this information, the three most common multimedia training methods for an ERP system, including the lecture, the video-based tutorial, and the paper-based tutorial methods, were chosen to deliver ERP exercises. See Figure 1. Each method/format allows a different combination of multimedia (words and pictures) to be used in exercise instruction. The unique characteristics of these teaching methods are explained below.

Figure 1:
Multimedia Teaching Methods Addressing ERP Learning Challenges

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Lecture. Sweeney and Reigeluth (1984, p. 9) defined a lecture as "a formal monologue delivered to a group." The lecture can be presented to large numbers of listeners at once. Instructors have complete control over the lecture and training pace. It is up to instructors to modify content and speed to suit learners' needs during the presentation (Sweeney & Reigeluth, 1984; Briziarelli, 1997). The lecture places a heavy reliance on listeners' memory and requires learners' prolonged concentration (Sweeney & Reigeluth, 1984). Sweeney and Reigeluth (1984) suggested that the lecture is a suitable method to deliver materials unfamiliar to learners. Instructors can stimulate the interest of the audience by providing introductory information about the materials. Instructors can also answer learners' questions (Briziarelli, 1997) and create a socially rich learning environment by encouraging interaction between the teacher and the students (Nemanich, Banks, & Vera, 2009).

Video-based tutorial. According to Xiao et al. (2004), the video-based tutorial is considered one of the most effective online instructional tools. The information presented in the video-based tutorial can be conducted in multiple modalities (Van der Meij & Van der Meij, 2014) that allow learners to process information more effectively (Mayer, 2003; Xiao et al., 2004; Clark & Vaivio, 1991). When the video-based tutorial is used for software training, learners can easily follow and observe actions because it displays a task sequence just as they see it on their computer screens (Van der Meij & Van der Meij, 2014). While an instructor controls the pace of lecture/demonstration instruction, learners can pause the video lecture when they need more time to process information to fit their learning pace. They can repeat the instruction until they understand it (Brecht, 2012; Simpson, 2006). Van der Meij & Van der Meij (2013, p. 213) warned about viewer passivity, or the "couch potato effect," when using the video-based tutorial.

Paper-based tutorial. According to Van der Meij & Van der Meij (2014), the paper-based tutorial allows learners to quickly skim through the tutorial to get a first impression of the nature of the content and task instruction. When the task instruction is broken down into steps, a table of contents can quickly help learners find information on a specific step. With the paper-based tutorial, learners have complete control over the pace of processing information. They can quickly go through the task instruction steps that are easy to understand and slowly go through more complex ones. The paper-based tutorial invites active processing from learners; it requires learners to interpret the task instruction and produce a self-explanation during the task execution.

This study aims to understand students' perceptions of and intention to use these multimedia teaching methods for learning the SAP ERP system. This study employed the technology acceptance model (TAM) theoretical framework to capture students' perceptions of and intention to use the multimedia teaching methods. The following section discusses the TAM framework.

Theoretical Development: Technology Acceptance Model for the Multimedia Teaching Methods

TAM, developed by Davis et al. (1989), is considered one of the most popular information systems theories used to explain how users come to accept and use a new system/technology (Yousafzai et al., 2007). TAM was an adaptation of Fishbein and Ajzen's theory of reasoned action (TRA), a model that was rooted in the social psychology field and has proven successful in predicting and explaining humans' behavioral intentions (Davis et al., 1989). One of the key measures of successful new system implementation is to achieve an intended level of usage of the new system (Amoako-Gyampah & Salam, 2004). Davis et al. (1989) tailored the TRA to specifically explain individuals' behavioral intentions to use new information technology. According to Davis et al. (1989), TAM posits that a user's beliefs about a new system/technology formed his/her attitude toward using the system/technology, which, in turn, influenced

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his/her behavioral intention to use the system/technology. Davis et al. (1989) explained that two fundamental beliefs that determined a user's attitude towards using new system/technology are perceived ease of use (PEOU) and perceived usefulness (PU). Davis et al. (1989, p. 320) defined PU as "the degree to which a person believes that using a particular system would enhance his or her job performance," and PEOU as "the degree to which a person believes that using a particular system would be free of effort." Attitude (Att) was defined as "an individual's positive or negative feelings about performing the target behavior" (Davis et al., 1898, p. 984). Behavioral intention (BI) was defined as "a measure of the strength of an individual's intention to perform a specified behavior" (Davis et al., 1989, p. 984). That is, when a user perceives a new technology is easy to use and helps improve his/her job performance, the user forms a positive attitude toward using the new technology. His/her attitude, in turn, positively influences his/her intention to use the new technology. Over the past few decades, various modifications and extended versions of TAM have been developed (Yousafzai et al., 2007; Venkatesh et al., 2003). Venkatesh et al. (2003) observed these TAM-based studies and found that the relationship between Att and BI was insignificant in the presence of effort expectancy (equivalent to PEOU) and performance expectancy (equivalent to PU) in the model. They believed that the relationship between Att and BI was spurious and thus, excluded Att from the original TAM.

The meta-analysis of TAM conducted by Yousafzai, Foxall, and Pallister in 2007 concluded that the simplicity and robustness of TAM's predictive power made the model easy to apply to different disciplines/subjects (Slatten, 2012). Further, non-IT-related research subjects have also adopted TAM to explain perceptions influencing an individual's intention to adopt non-technological products and certain behavior. Ma et al. (2017) applied TAM to explain consumer acceptance of an apparel product's sustainability labels. Slatten (2012) modified the TAM to explain factors influencing nonprofit organizations' attitudes and intention to pursue certification programs.

TAM has not been tested for acceptance of multimedia teaching methods for ERP systems. This study is one of the first to use the original TAM to investigate students' acceptance of multimedia teaching methods for ERP systems. The original TAM is chosen for this study because several studies of the training influence on ERP system implementation success showed that Att positively influenced BI (e.g., Amoako-Gyampah & Salam, 2003; Zabukovsek et al., 2019; Bueno & Salmeron, 2008; Alshare & Lane, 2011).

The teaching methods with multimedia instruction are designed to be easy to follow and nurture deep learning, which would help students overcome the ERP learning challenges centered on poor usability. This study aims to understand students` perceptions of multimedia teaching methods and whether the students would use it for learning ERP systems in the future. In this regard, students' perceptions of the multimedia teaching methods and their influence on the intention to use them for learning ERP systems should reflect the technology adoption behavior model explained by TAM.

Hypothesis Development

According to Davis et al. (1989), PEOU is one of two fundamental beliefs that influence Att, which, in turn, impacts BI. The PEOU-Att relationship is based on mechanisms that PEOU influences users' self-efficacy and personal control. When users interact with a particular system with ease, their sense of self-efficacy and personal control over their ability to operate the system increases. In the context of this study, PEOU is defined as the degree to which a student perceives that the multimedia teaching methods for the SAP ERP system will be easy to use and its multimedia instruction will be easy to understand and follow. Att is defined as a student's positive

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or negative feelings about using the multimedia teaching methods for learning and understanding the SAP ERP system.

According to Tanggoro (2015), multimedia teaching methods could help learners understand learning materials easier, increase learning motivation, and prevent learners from being bored. Smith et al. (2011) investigated student physical therapists' perceptions of a multimedia teaching method for knee and ankle foot examination techniques. Among investigated perceptions, the study found that the majority of participants perceived the multimedia instructions were easy to follow. They also believed that the multimedia teaching method was interesting and worth their time for learning. As discussed earlier, ERP systems have been perceived to have poor usability of the interface due to the technological difficulties. This study uses three multimedia teaching methods, including the lecture, the video-based tutorial, and the paper-based tutorial on delivering hands-on SAP ERP exercises. Each teaching method uses multimedia instructions designed to be clear and easy to understand and follow. Thus, students will likely develop a positive attitude toward using the multimedia teaching methods when learning the SAP ERP system. The following null hypotheses are posited: *[H1a] / [H1b] / [H1c]: PEOU will not have a positive effect on Att toward using the [lecture] / [video-based tutorial] / [paper-based tutorial] for the SAP ERP system.*

PU is the other fundamental belief that positively influences Att. According to Davis et al. (1989), the PU-Att relationship is based on the idea that users develop a positive attitude toward using new technology that improves their job performance. In the context of our study, PU is defined as the degree to which a student perceives that using the multimedia teaching methods will enhance their performance of learning the SAP ERP system.

Several studies across various disciplines showed an association between multimedia-enhanced learning performance and the positive attitude toward multimedia teaching methods. Hayes & Robinson (2011) used multimedia computer-assisted instruction to supplement their experiential teaching approach with students in an introductory graduate-counseling technique class. The majority of students perceived that the multimedia instruction helped them become more productive in their educational process and facilitated higher learning. Based on the attitude survey responses, students showed positive attitudes toward the multimedia computer-assisted instruction. Brewster (1996) used a multimedia classroom to deliver techniques for teaching abnormal psychology. Students perceived that the visual displays helped them focus on the learning subject. The study concluded that students perceived the multimedia approach and instructional method favorably. Eyyam and Yaratan (2014) investigated student attitudes toward a computer-assisted multimedia-teaching tool and assessed whether it improved students' academic achievement. The computer-assisted multimedia teaching tool was developed and used by instructors to teach students in a mathematics class. Their study found that the multimedia teaching tool had a positive effect on their learning performance. Students also expressed positive attitudes toward the use of the multimedia teaching tool. Liu et al. (2008) studied the impact of media richness on e-learning technology acceptance. The study used TAM as the theoretical framework to investigate students' perceptions of three different richness levels of media combination, including text-audio, audio-video, and text-audio-video used to present e-learning contents; further, the study investigated whether their perceptions influenced their intention to use the e-learning platform. The study found that the media richness had a positive influence on PU, which, in turn, had a positive impact on Att. The richer the media, the higher the perceived usefulness of the e-learning method and the stronger the intention to use the e-learning method.

The multimedia teaching methods could foster ease for students learning to use the SAP ERP system to complete hands-on exercises and help students understand the underlying business concepts of SAP ERP operating sequences. Thus, students will

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likely perceive the multimedia teaching methods as useful for learning the ERP systems, which, in turn, cultivates a positive attitude toward using the multimedia teaching methods for learning the SAP ERP system. The following null hypotheses are posited:
[H2a] / [H2b] / [H2c]: PU will not have a positive effect on Att toward using the [lecture] / [video-based tutorial] / [paper-based tutorial] for ERP systems.

According to the original TAM, PEOU also has a positive influence on PU. Davis et al. (1989) explained that the PEOU-PU relationship freed-up effort through the improved ease of use of the new technology that could be diverted to accomplish more work with the same effort. A similar explanation given by Venkatesh and Davis (2000) was that when users spend less effort to use new technology, the users use the new technology more, which, in turn, impacts their job performance. Since the multimedia instruction is easy to understand and follow, students would learn operating sequences of ERP functions with less effort. Students could then put effort saved from improved ease of use to understand underlying business aspects of the SAP ERP system and/or accomplish learning of the SAP ERP system more efficiently. Therefore, when students find the multimedia teaching methods easy to understand and follow, they will likely find the multimedia teaching methods to be useful for learning the SAP ERP system. The following null hypotheses are posited:
[H3a] / [H3b] / [H3c]: PEOU will not have a positive effect on PU of the [lecture] / [video-based tutorial] / [paper-based tutorial] for the SAP ERP system.

Davis et al. (1989) noted that BI is directly influenced by Att and PU. The Att-BI relationship is based on the idea that users would be more likely to use a particular system when they regard the system positively (Davis et al., 1989). For the context of this study, BI is defined as a measure of the strength of a student's intention to use the multimedia teaching methods for learning the SAP ERP system.

Smith et al. (2011) found that the majority of student physical therapists perceived the multimedia teaching method to be interesting. They wanted to use the method again if it is available. Eyyam and Yaratan (2014) found that almost half of the students preferred the use of computer-assisted multimedia teaching in class. However, almost one-third of the students were indecisive about their preference. The authors explained that one of possible reasons for their indecisiveness was due to their resistance to change. It was the first time these students experienced computer-assisted multimedia instruction, which was a tremendous change from the traditional teaching method. The authors believed that students will favor using computer-assisted multimedia teaching if this educational technology is used for a longer period of time. Liu et al. (2009) found that students' attitudes toward e-learning with media-rich content positively influenced their intention to use the multimedia e-learning platform.

Students will likely develop a positive attitude toward the multimedia teaching methods for the SAP ERP system because the multimedia teaching methods are likely to be easy to use and useful for learning how to operate the SAP ERP system, which, in turn, positively influences their intention to use these for learning the ERP systems. Therefore, the following null hypotheses are proposed:
[H4a] / [H4b] / [H4c]: Att will not have a positive effect on BI for the [lecture] / [video-based tutorial] / [paper-based tutorial] for the SAP ERP system.

Davis et al. (1989) emphasized that while Att and PU directly influence BI, PU has a stronger influence on BI than the Att on BI. The authors explained that users formed their intention to use a particular system when they perceived that it could enhance their job performance regardless of their attitudes toward the system. The enhanced job performance could lead to achieving various rewards such as pay raise and job promotion. Across many empirical TAM studies, PU has consistently been a fundamental driver of BI (Venkatesh & Davis, 2000). Smith et al. (2011) found that student physical therapists perceived the multimedia teaching method to be useful for

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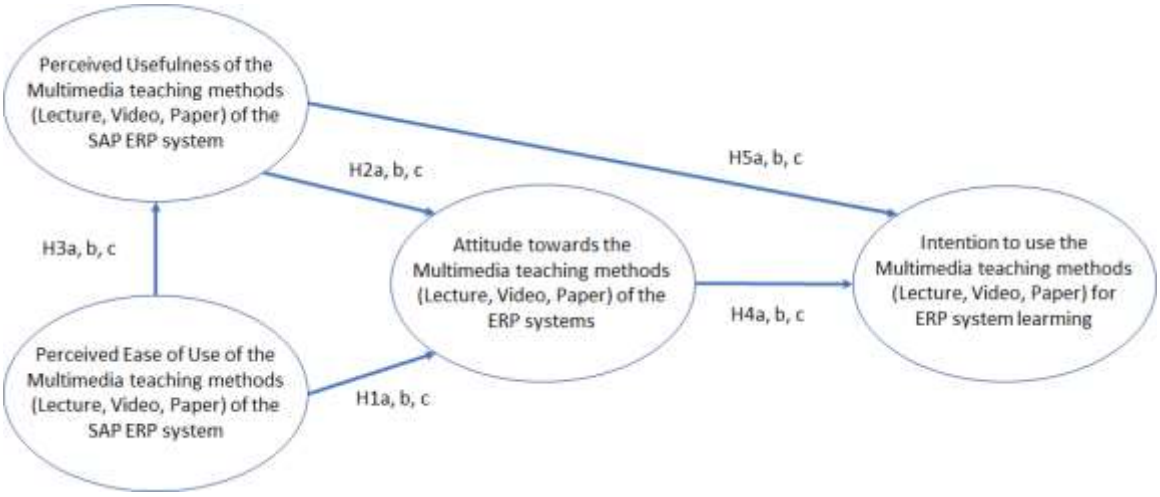
reviewing material previously learned. Their study showed that the majority of students intend to use the multimedia teaching method again. Liu et al. (2009) found that the perceived usefulness of e-learning with multimedia content positively influences students' intentions to use the e-learning platform.

Students will likely develop a strong intention to use the multimedia teaching methods for learning the SAP ERP system because the methods could help students use SAP ERP with ease and learn underlying business concepts of the SAP ERP operative sequences. Thus, the following null hypotheses are proposed:
[H5a] / [H5b] / [H5c]: PU will not have a positive effect on BI for the [lecture] / [video-based tutorial] / [paper-based tutorial] for the SAP ERP system.

Figure 2 shows the research hypothesis based on the original TAM.

Figure 2:
TAM and Research Hypothesis



Research Methodology

Multimedia Instructional Designs

This study used three hands-on ERP exercises developed by SAP to train students. These exercises were sales order cycle, purchasing, and pricing exercises. This study also used Mayer's (2009) multimedia instructional design principles as a guideline to develop multimedia instructions for each exercise in three methods/formats, including the lecture, the video-based tutorial, and the paper-based tutorial formats. A snapshot of Mayer's (2009) multimedia instructional design principles is shown in Appendix A.

The flow of content for each exercise was the same for all teaching methods. Each exercise started with introducing business concepts and key terms used within the exercise (Mayer's Pre-training principle). Then hands-on exercise steps with a business concept behind each step were described. Each hands-on exercise was broken down into steps or sections (Mayer's Segmenting principle). At the beginning of each step-section, students were reminded of the current step in the whole process, the business concepts behind it, and what needs to be accomplished.

The instructor-led classroom lecture used the PowerPoint presentation for explaining business concepts. The SAP ERP system was used during the exercise demonstration and shown on a classroom screen projector. The instructor verbally

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cautioned students to pay extra attention to common mistakes (Mayer's Signaling principle). The instructor also reiterated these business concepts during an exercise demonstration to make sure that students could connect SAP ERP operating sequences with underlying business concepts. The whole class followed an exercise demonstration at the same pace. Students usually completed an exercise in class (one two-and-a-half-hour session or two 75-min sessions). The instructor provided support during a demonstration.

The video-based tutorial used screen capture software to record the SAP ERP exercise demonstration from a computer screen along with an instructor's voice narration (Mayer's Voice principle). The narration was also in a conversation style (Mayer's Personalization principle). An exercise demonstration was broken down into small steps. Each step used a separate video clip. The instructor kept the voice narration at the same speed as the on-screen demonstration (Mayer's Temporal cognitive principle). Like the instructor-led class lecture/demonstration, the voice narration cautioned students to be more careful where a common mistake was made (Mayer's Signaling principle). The voice narration also reiterated business concepts during an exercise demonstration so students could connect SAP ERP operating sequences with underlying business concepts.

The paper-based tutorial was in PDF format. The paper-based tutorial used texts to explain operating sequence steps along with screenshots of SAP ERP functions (Mayer's Temporal cognitive principle). In addition, each screenshot also included pointers and short text descriptions to accommodate students which command/button to click and which textbox to enter data (Mayer's Redundancy principle). Commands frequently used, such as process, return, and save, did not require pointers with short text descriptions. The paper-based tutorial used a "Note" to reiterate business concepts underlying the operating sequence (Mayer's Signaling principle). The paper-based tutorial also used a "Caution" wherever a common mistake was made so students could avoid making the same mistake (Mayer's Signaling principle). Figure 3 shows an example of the paper-based tutorial's picking order step from the sales order cycle exercise.

Both video-tutorial and paper-based tutorial materials were organized and available for students to access on the LMS - Blackboard. Students could watch the video-based tutorials on the Blackboard. If they use the paper-based tutorials, they will have to download materials on their computers first. With the video-based tutorials and the paper-based tutorial, students did the exercises outside class hours. When students encountered problems, they received support from the instructor through e-mail communication and web conferencing.

A focus group of 10 students per multimedia teaching method was conducted to check the clarity of instructions for each exercise and identify common mistakes students made. After each exercise was completed, students were asked to identify any confusion of instruction. For the instructor-led lecture/demonstration, students were also asked about the pace of in-class instruction and demonstration. For the video-based tutorial, students were also asked about the pace of narration and demonstration. Student feedbacks were used to guide the instructor to improve the multimedia instructions.

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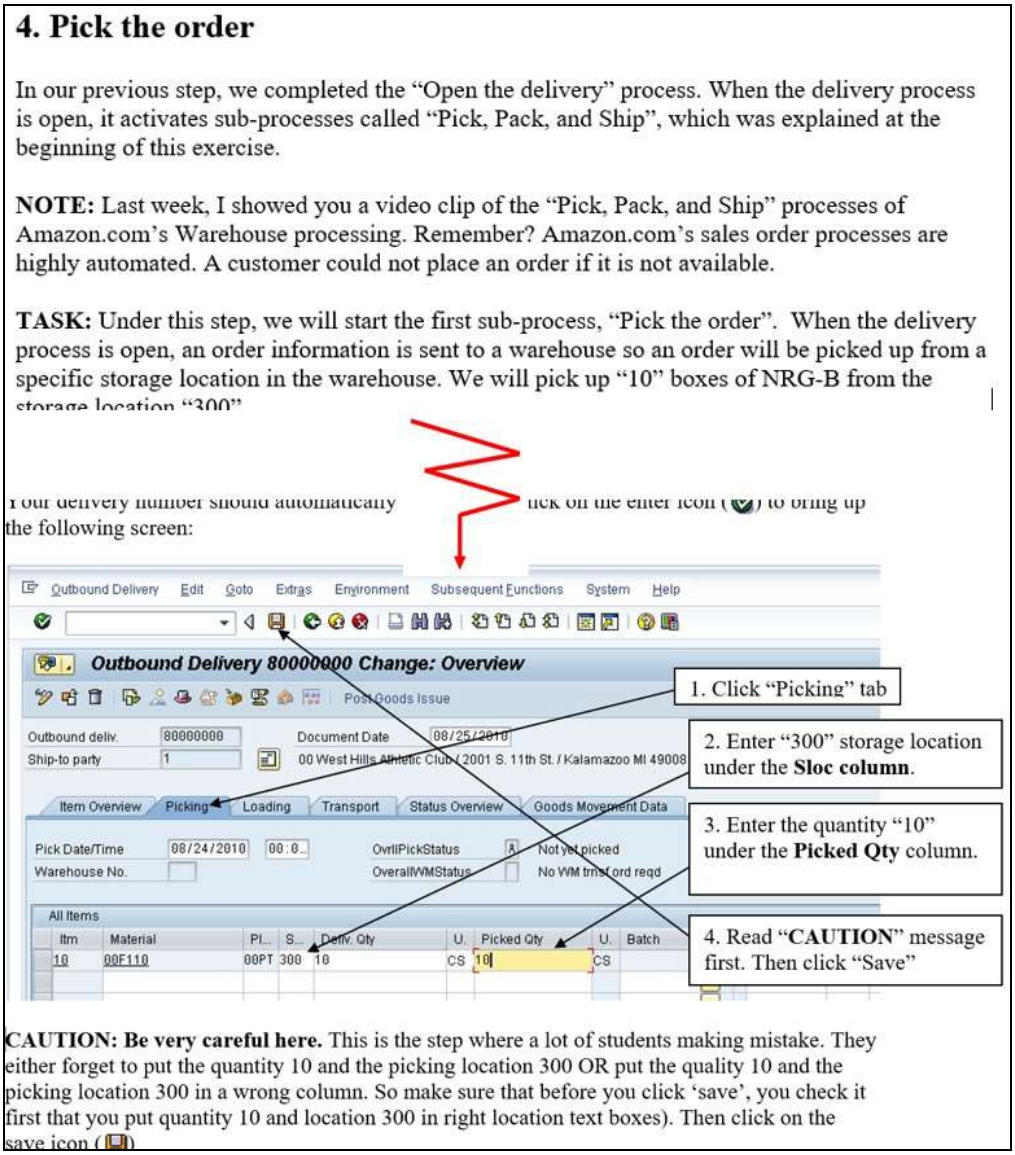
Figure 3:
Paper-based Tutorial's Multimedia Instruction



Measurement Instrument Development

The survey consisted of two parts. The first part consisted of various demographic information, including gender, discipline, and college year among other variables. The second part consisted of construct item questions from PEOU, PU, Att, and BI. To keep the survey at a manageable length, the researchers modified four PEOU items and four PU items from Davis (1989) and Venkatesh et al. (2003) to fit the context of the multimedia teaching method for the ERP systems. Four Att items were adapted from Davis et al. (1989) and Venkatesh et al. (2003). Lastly, three BI items were adopted and modified from Venkatesh et al. (2003). All PEOU, PU, Att, and BI items were measured on a 5-point Likert scale: 1 being "Strongly disagree" and 5 being "Strongly agree." Appendix B shows survey questions of all construct items. The survey also required students to share their opinion in open-ended questions about each multimedia teaching method.

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Data Collection Procedure

This study's sample consisted of business students enrolled in an introduction of management information systems course at a four-year, private university in the Northeastern region of the U.S. Most business majors were required to take the course during their junior or senior years. The course devotes one-third of class hours to the ERP subject and SAP ERP hands-on activities. The main objectives of teaching the ERP and hands-on SAP ERP exercises were to provide students with a foundation knowledge of ERP, train them to be familiar with the SAP ERP system, and use the SAP ERP system as a focal point for integrating business knowledge across functional disciplines. Before students started the weeks of hands-on exercises, the instructor explained the concept of ERP systems and their integrated nature, the benefit of ERP systems for business, and the market demand for a workforce with ERP knowledge and skills.

This study aimed to understand how students' PEOU and PU influenced their Att and BI for three multimedia teaching methods (the lecture, the video-based tutorial, and the paper-based tutorial) and understand how relationships between these variables are different from one teaching method to another. To make sure that each student experienced three different multimedia teaching methods, this study developed three multimedia teaching methods for each exercise. Every class section was required to complete three different exercises, each with a multimedia teaching method that was different from the exercise before it. Table 1 shows combinations of the SAP ERP exercises and the multimedia teaching methods randomly used for different class sections.

Table 1:
SAP ERP Exercises – Multimedia Teaching Method Combinations

Combination #	Sales Order Cycle	Purchasing	Pricing
1	Lecture (L)	Video (V)	Paper (P)
2	L	P	V
3	V	L	P
4	V	P	L
5	P	L	V
6	P	V	L

All sections were taught by one instructor. Students were required to complete each exercise within one week. The instructor encouraged students to experience all three types of multimedia teaching methods. However, the instructor allowed students to choose the multimedia teaching methods that they preferred when they requested. After completing three SAP exercises, students who used all three multimedia teaching methods were asked to complete the online survey voluntarily. Out of 488 survey responses received, 456 were complete.

Results

Demographic and Students' Feedback

Fifty-five percent of respondents were male, and 45 percent were female. The majority of respondents were seniors (56%), while the rest were juniors (45%). Forty percent of respondents majored in management, 29 percent majored in accounting, 27 percent majored in marketing and sports, and four percent majored in finance. The majority of respondents, 54 percent, expected to receive an A in the class. Thirty-nine percent expected to receive a B, and 7 percent expected to receive a C.

The open-ended questions asked students to share their opinions about the multimedia teaching methods. Table 2 shows examples of student feedback. Student feedback revealed several characteristic keywords for each teaching method. Table 3

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summarizes these keywords and shows how many times (percentages) they were mentioned in the 456 responses.

Table 2:
Examples of student feedback

Selected instructor-led lecture/demonstration feedback:
"It made it easier to understand the SAP system for first-time users."
"The instructor kept everyone at the same pace and helped whoever needed it."
"It is just hard when others are there and not paying attention and other students are."
"Having to wait for each person basically after completing a step, took away from focusing on the business concepts. Therefore I tended to focus my attention towards trying to keep up and follow <instructor>'s arrow on the <screen projector>."
"Even when I paid attention and made a small mistake I felt very bad holding up the whole class and was more nervous to make another mistake than to actually focus on learning."
Selected video-based tutorial feedback:
"I could listen and not take my eyes off the SAP screen."
"…, I thought that the video was extremely helpful. It let me go back where I didn't understand but still heard <the instructor>'s voice which helped talked you through the steps and understanding the concepts."
"Very easy to follow, can go at your own pace."
"This was my favorite version because it was very clear, and I didn't need to wait for my classmates to finish."
"Clearer, felt like I could understand it better than the other exercises, I could go back too."
"Had to pause at the right spots so that took up time."
Selected paper-based tutorial feedback:
"honestly with two screens open, and once you got to know the format of the instructions, it was all very clear and easy, if the second and third sections had been offered in this format they could have each easily been finished within 20 minutes."
"I liked the paper-based tutorial, only thing I did not like was there were one or two technical difficulties, but I was easily able to fix them with some process of elimination due to unintentionally skipping a step."
"Very long process and lots of reading, had to reread to make sure I understood the business concept and the technical practices."
"I found myself just doing the exercise and not pay attention at all."
"I was constantly scared I was doing something wrong and would have to redo the entire thing."

Table 3:
Keywords from students' opinion about each teaching method

Lecture		Video-based Tutorial		Paper-based Tutorial	
(+) Clear, Easy to understand, Easy to follow	71%	(+) Clear, Easy to understand, Easy to follow	78%	(+) Clear, Easy to understand, Easy to follow	59%
(+) In-class support	46%	(+) Pace – Comfortable to follow	56%	(+) Easy to use – scroll up/down	66%
(+) In-person demonstration	34%	(+) Easy to use videos - rewind	56%	(+) Pace – Self-control pace, Fast	56%
(+) Pace - Fast, Efficient	25%	(-) Pace – Slow, Too many videos	31%	(-) Unsure doing it correctly	43%
(-) Pace – Slow / Lost attention	62%	(-) Not easy to use videos - rewind	23%	(-) Too much reading	38%

For the lecture, 71% of the responses mentioned that the instruction was clear, and easy to understand and follow. Forty-six percent of the responses indicated that students liked that the instructor provided technical support in person. Thirty-four percent of the responses pointed out that they felt less anxious when they followed the in-person instructor demonstration. While 25% of participants indicated that the

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teaching pace was efficient, 62% of the participants felt that the teaching pace was too slow because they had to wait for their classmates to catch up before the instructor continued the instruction. Some expressed that they were bothered by their classmates who did not pay attention, which caused everyone to wait for them to catch up. Others explained that while they waited for the instructor to provide extra support to some classmates, they lost attention to the exercises.

For the video-based tutorial, 78% of the responses indicated that the instruction was clear, and easy to understand and follow. Fifty-six percent of the responses said that it was useful that they could rewind a video so they could rewind and watch areas where they could not catch up earlier. However, 23% of the responses also indicated that it was not easy to rewind to an exact area they wanted to watch. Thirty-one percent of the responses mentioned that there were too many videos for an exercise, and since they had to watch each video with the pace of the instruction, they felt that the video-based tutorial was too slow.

For the paper-based tutorial, 59% of the responses indicated that the instruction was clear, and easy to understand and follow. Most of the students did not print the tutorial but read the PDF-format tutorial on their computer screen alongside the SAP ERP program. Sixty-six percent of the responses mentioned that the paper-based tutorial was easy to scroll through each section and scroll back to an area students want to reread. Fifty-six percent of the responses mentioned that they liked the paper-based because they had complete control over the pace of an exercise. Forty-six percent of the responses explained that they felt anxious because they were not sure that they did it correctly. Thirty-eight percent of the responses mentioned that the explanation in the tutorial was too long to read.

Measurement Model Results

Confirmatory factor analysis (CFA) was conducted using SPSS 23.0; the acceptable factor loading results further confirmed the SEM Fit Indices by AMOS 23.0. The CFA result showed no sign of cross-loading, and the factor structure matched the model in this study.

Item reliability of a measurement model is commonly estimated by assessing Cronbach's alpha (Hair et al., 2014). During the scale purification, one item from each of the following constructs, PEOU, PU, and Att, was removed from each measurement model to meet an acceptable degree, resulting in the values of Cronbach's alpha ranging from 0.88 to 0.97 for the lecture model, 0.89 to 0.98 for the video model, and 0.93 to 0.99 for the paper model. Table 4 shows the Cronbach's alpha values. All Cronbach's alpha values well surpassed the recommended value of 0.7 (Hair et al., 2014), indicating acceptable item reliability for all measurement models.

Convergent validity is commonly estimated by assessing factor loadings and average variance extracted (AVE) for a construct (Fornell & Larcker, 1981). The factor loadings of all items and the AVEs for all constructs from each measurement model well surpassed the recommended 0.50 values (Fornell & Larcker, 1981), indicating acceptable convergent validity for all measurement models. Table 5 shows the AVE, SQRT (AVE), and correlation values.

Discriminant validity is commonly estimated by assessing the square root (SQRT) of the AVE value for a construct. All SQRT (AVE) values for all constructs were higher than the correlation values (Fornell & Larcker, 1981), suggesting that the measurement scales were acceptable for discriminant validity (Table 5).

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Table 4:
Cronbach's Alpha Values

Items	Mean			Deviation			Parameter Est.			Factor Loading (>=0.5)			Cronbach's Alpha (>=0.70)		
	L*	V*	P*	L	V	P	L	V	P	L	V	P	L	V	P
PEOU1	3.77	4.32	3.31	1.17	1.07	1.54	0.95	0.95	0.99	0.90	0.91	0.98	0.97	0.98	0.99
PEOU2	3.72	4.28	3.30	1.18	1.09	1.56	0.94	0.98	0.96	0.89	0.95	0.93			
PEOU3	3.72	4.28	3.35	1.19	1.10	1.52	0.98	0.98	0.99	0.96	0.96	0.98			
PU1	4.08	4.21	3.78	0.70	0.67	0.94	0.90	0.77	0.91	0.81	0.59	0.83	0.93	0.89	0.96
PU2	4.09	4.17	3.76	0.74	0.72	0.95	0.92	0.93	0.96	0.84	0.86	0.92			
PU3	4.06	4.19	3.76	0.71	0.68	0.96	0.91	0.89	0.97	0.82	0.79	0.95			
Att1	4.07	4.41	3.68	1.03	0.88	1.25	0.83	0.90	0.91	0.69	0.81	0.84	0.88	0.93	0.94
Att2	4.20	4.40	3.76	0.89	0.87	1.13	0.80	0.89	0.88	0.64	0.78	0.77			
Att3	4.16	4.43	3.70	0.92	0.82	1.18	0.90	0.93	0.95	0.81	0.87	0.91			
BI1	3.59	3.90	3.28	0.88	0.85	0.98	0.93	0.92	0.92	0.86	0.85	0.84	0.93	0.93	0.93
BI2	3.63	3.92	3.27	0.87	0.86	1.00	0.87	0.87	0.91	0.75	0.76	0.82			
BI3	3.59	3.91	3.29	0.85	0.84	0.97	0.91	0.90	0.90	0.83	0.81	0.91			

*L=Lecture, V=Video, P=Paper

Table 5:
AVE, SQRT (AVE), and Correlation Values

Model	Measurement	AVE	SQRT(AVE)	PEOU	PU	Att	BI
Lecture	**PEOU**	0.914	0.956	0.956			
	PU	0.823	0.907	0.441***	0.907		
	Att	0.714	0.845	0.520***	0.548***	0.845	
	BI	0.813	0.902	0.692***	0.628***	0.543***	0.902
Video	**PEOU**	0.941	0.970	0.970			
	PU	0.747	0.864	0.492***	0.864		
	Att	0.823	0.907	0.588***	0.709***	0.907	
	BI	0.806	0.898	0.675***	0.709***	0.623***	0.898
Paper	**PEOU**	0.962	0.981	0.981			
	PU	0.900	0.949	0.542***	0.949		
	Att	0.838	0.915	0.707***	0.665***	0.915	
	BI	0.825	0.908	0.755***	0.693***	0.709***	0.908

The measurement model fits (overall, the lecture, the video-based tutorial, and the paper-based tutorial) were calculated by using AMOS 23.0. Five common model-fit indices, including Cmin/DF, RMSEA, TLI, CFI, and NFI were used to estimate the measurement models. All model-fit indices met the fit indices' ideal cut-off values (Hair et al., 2014), indicating that the measurement models were well-fitted to the collected data, and TAM was generally applicable to the prediction of students' intention to use these multimedia teaching methods to learn the SAP ERP system. Table 6 shows the Fit indices.

Table 6:
Fit Indices

Fit Indices	Cmin/DF	RMSEA	TLI	CFI	NFI
Ideal Cut-off*	< 3.0	< 0.05	> 0.95	> 0.95	> 0.95
Acceptable Cut-off *	< 10.0	< 0.08	> 0.90	> 0.90	> 0.90
Overall Model	2.504	0.033	0.984	0.989	0.981
Lecture Model	2.774	0.062	0.979	0.984	0.976
Video Model	2.121	0.050	0.988	0.991	0.983
Paper Model	2.617	0.060	0.986	0.990	0.984

*Hair et al. (2014)

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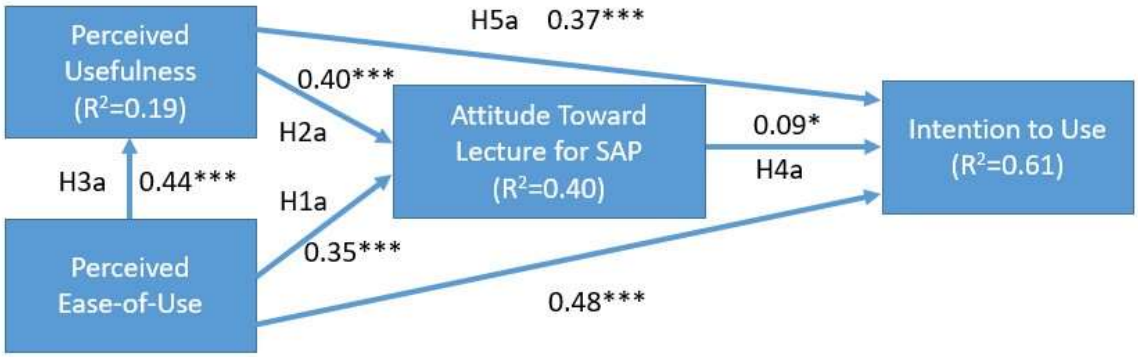
Path Analysis

For the lecture model, PEOU positively influenced Att (path coefficient = 0.35, p < 0.001) and PU (path coefficient = 0.35, P < 0.001). Therefore, hypotheses H1a and H3a were rejected. PU positively influenced Att (path coefficient = 0.40, p < 0.001) and BI (path coefficient = 0.37, p < 0.001). Thus, hypotheses H2a and H5a were rejected. Att positively influenced BI (path coefficient = 0.09, p < 0.05). Therefore, hypothesis H4a was rejected. The model also showed that PEOU positively influences BI (path coefficient = 0.48, p < 0.001). Figure 4 shows the path coefficients of the lecture model.

Figure 4:
Results of the Structural Model – Instructor-led Lecture/Demonstration Model



Significance of Correlations: *p<0.050, **p<0.010, ***p<0.001

PEOU, PU, and Att toward using the lecture to learn the SAP ERP system collectively explained 61% of the variance in BI. The standardized total effect of PEOU on BI was 0.69 with a direct effect of 70% and indirect effects of 30%. The standardized total effect of PU on BI was 0.41 with a direct effect of 91% and an indirect effect of 9%. The standardized total effect of Att on BI was 0.09.

PEOU and PU represented 40% of the variance in Att. The standardized total effect of PEOU on Att was 0.53 with a direct effect of 67% and an indirect effect of 33%. The standardized total effect of PU on Att was 0.40.

PEOU represented 19% of the variance in PU. The standardized total effect of PEOU on PU was 0.44. Table 7 summarizes the details of the lecture's direct, indirect, and total effects for each individual path.

For the video-based tutorial model, PEOU had a significant and positive impact on Att (path coefficient = 0.40, p < 0.001) and PU (path coefficient = 0.49, P < 0.001). Thus, hypotheses H1b and H3b were rejected. PU positively influenced Att (path coefficient = 0.39, p < 0.001) and BI (path coefficient = 0.44, p < 0.001). Therefore, hypotheses H2b and H5b were rejected. Att positively affected BI (path coefficient = 0.15, p < 0.010). Thus, hypothesis H4b was rejected. The model also showed that PEOU positively influenced BI (path coefficient = 0.37, p < 0.001). Figure 5 shows the path coefficients of the video-based tutorial model.

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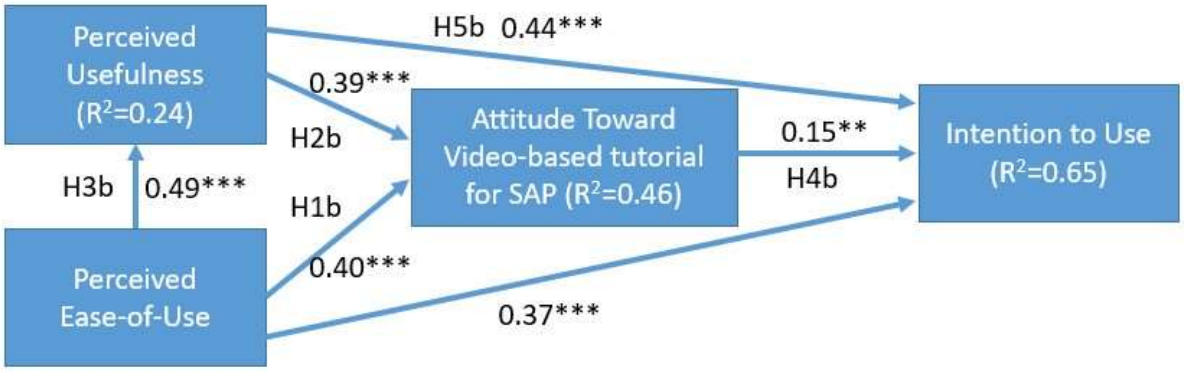
Table 7:
Path Analysis of the Lecture Model

Lecture model	R^2	Direct effect (% of Total effect)	Indirect effect (% of Total effect)	Indirect effect (% of Total effect)	Indirect effect (% of Total effect)	Total effect (% of Sum of total effect)
Effect on BI	0.61	**->BI**	**->Att->BI**	**->PU->BI**	**->PU->Att->BI**	
PEOU		0.48 (70%)	0.03 (5%)	0.16 (24%)	0.02 (2%)	0.69 (58%)
PU		0.37 (91%)	0.04 (9%)			0.41 (34%)
Att		0.09 (100%)				0.09 (8%)
Effect on Att	0.40	**->Att**	**->PU->Att**			
PEOU		0.35 (67%)	0.18 (33%)			0.53 (57%)
PU		0.40 (100%)				0.40 (43%)
Effect on PU	0.19	**->PU**				
PEOU		0.44 (100%)				0.44 (100%)

Figure 5:
Results of the Structural Model – Video-tutorial Model



Significance of Correlations: *p<0.050, **p<0.010, ***p<0.001

PEOU, PU, and Att toward using the video-based tutorial to learn the SAP ERP system collectively explained 65% of the variance in BI. The standardized total effect of PEOU on BI was 0.67 with a direct effect of 55% and indirect effects of 45%. The standardized total effect of PU on BI was 0.50 with a direct effect of 88% and an indirect effect of 12%. The standardized total effect of Att on BI was 0.15.

PEOU and PU represented 46% of the variance in Att. The standardized total effect of PEOU on Att was 0.59 with a direct effect of 68% and an indirect effect of 32%. The standardized total effect of PU on Att was 0.39.

PEOU represented 24% of the variance in PU. The standardized total effect of PEOU on PU was 0.49. Table 8 summarizes the details of the video-based tutorial model's direct, indirect, and total effects for each individual path.

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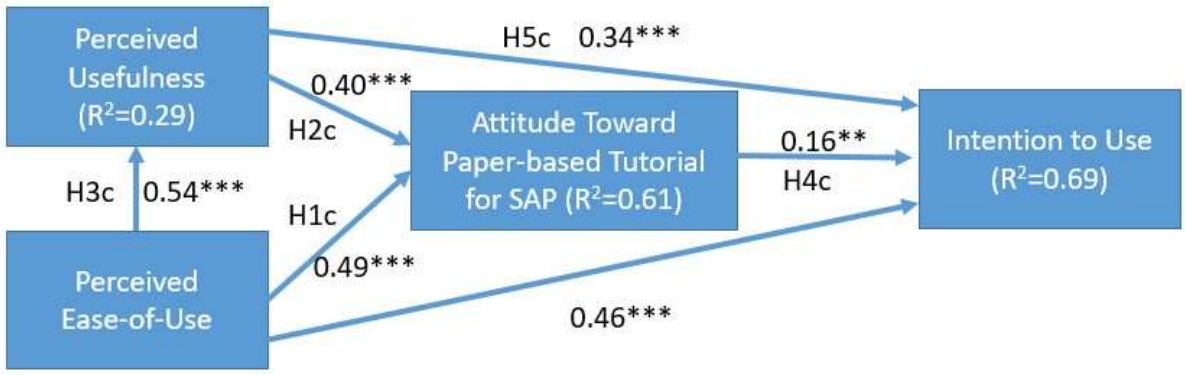
Table 8:
Path Analysis of the Video-based Tutorial Model

Video model	R^2	Direct effect (% of Total effect)	Indirect effect (% of Total effect)	Indirect effect (% of Total effect)	Indirect effect (% of Total effect)	Total effect (% of Sum of total effect)
Effect on BI	0.65	**->BI**	**->Att->BI**	**->PU->BI**	**->PU->Att->BI**	
PEOU		0.37 (55%)	0.06 (9%)	0.22 (32%)	0.03 (4%)	0.67 (51%)
PU		0.44 (88%)	0.06 (12%)			0.50 (38%)
Att		0.15 (100%)				0.15 (11%)
Effect on Att	0.46	**->Att**	**->PU->Att**			
PEOU		0.40 (68%)	0.19 (32%)			0.59 (60%)
PU		0.39 (100%)				0.39 (40%)
Effect on PU	0.24	**->PU**				
PEOU		0.49 (100%)				0.49 (100%)

For the paper-based tutorial model, PEOU positively influenced Att (path coefficient = 0.49, $p < 0.001$) and PU (path coefficient = 0.54, $P < 0.001$). Therefore, hypotheses H1c and H3c were rejected. PU had a significant and positive influence on Att (path coefficient = 0.40, $p < 0.001$) and BI (path coefficient = 0.34, $p < 0.001$). Thus, hypotheses H2c and H5c were rejected. The model showed that Att positively affected BI (path coefficient = 0.16, $p < 0.010$). Therefore, hypothesis H4c was rejected. As found in the previous two models, PEOU positively influenced BI (path coefficient = 0.46, $p < 0.001$). Figure 6 shows the path coefficients of the video-based tutorial model.

Figure 6:
Results of the Structural Model – Paper-tutorial Model



Significance of Correlations: *p<0.050, **p<0.010, ***p<0.001

PEOU, PU, and Att toward using the paper-based tutorial to learn the SAP ERP system collectively explained 69% of the variance in BI. The standardized total effect of PEOU on BI was 0.76 with a direct effect of 61% and indirect effects of 39%. The standardized total effect of PU on BI was 0.40 with a direct effect of 84% and an indirect effect of 16%. The standardized total effect of Att on BI was 0.16.

PEOU and PU represented 46% of the variance in Att. The standardized total effect of PEOU on Att was 0.71 with a direct effect of 69% and an indirect effect of 31%. The standardized total effect of PU on Att was 0.40.

PEOU represented 24% of the variance in PU. The standardized total effect of PEOU on PU was 0.54. Table 9 summarizes the details of the paper-based tutorial model's direct, indirect, and total effects for each individual path.

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Table 9:
Path Analysis of the Paper-based Tutorial Model

Paper model	R^2	Direct effect (% of Total effect)	Indirect effect (% of Total effect)	Indirect effect (% of Total effect)	Indirect effect (% of Total effect)	Total effect (% of Sum of total effect)
Effect on BI	0.69	**->BI**	**->Att->BI**	**->PU->BI**	**->PU->Att->BI**	
PEOU		0.46 (61%)	0.08 (10%)	0.18 (24%)	0.03 (5%)	0.76 (58%)
PU		0.34 (84%)	0.06 (16%)			0.40 (30%)
Att		0.16 (100%)				0.16 (11%)
Effect on Att	0.46	**->Att**	**->PU->Att**			
PEOU		0.49 (69%)	0.22 (31%)			0.71 (64%)
PU		0.40 (100%)				0.40 (36%)
Effect on PU	0.24	**->PU**				
PEOU		0.54 (100%)				0.54 (100%)

Mean Comparison of TAM Constructs across Three Teaching Methods

In order to understand the difference of PEOU, PU, Att, and BI between the three multimedia teaching methods, the paired t-test was used to compare the composite means for each of the TAM constructs across the three multimedia teaching methods. Table 10 shows the pair t-test results of the composite means comparison. Results indicate that the video-based tutorial demonstrated significantly higher median PEOU, PU, Att, and BI scores than those of the lecture and the paper-based tutorial. The lecture also showed significantly higher PEOU, PU, Att, and BI than those of the paper-based tutorial.

Table 10:
Mean Comparison of TAM Constructs across the Multimedia Teaching Methods

PEOU	Lecture (Std)	Video (Std)	Paper (Std)	Significant Difference
Lecture v. Video	3.74 (1.14)	4.29 (1.07)	-	***
Lecture v. Paper	3.74 (1.14)	-	3.32 (1.52)	***
Video v. Paper	-	4.29 (1.07)	3.32 (1.52)	***
PU	**Lecture (Std)**	**Video (Std)**	**Paper (Std)**	Significant Difference
Lecture v. Video	4.08 (0.67)	4.19 (0.63)	-	***
Lecture v. Paper	4.08 (0.67)	-	3.77 (0.92)	***
Video v. Paper	-	4.19 (0.63)	3.77 (0.92)	***
Att	**Lecture (Std)**	**Video (Std)**	**Paper (Std)**	Significant Difference
Lecture v. Video	4.15 (0.85)	4.41 (0.85)	-	***
Lecture v. Paper	4.15 (0.85)	-	3.71 (1.12)	***
Video v. Paper	-	4.41 (0.85)	3.71 (1.12)	***
BI	**Lecture (Std)**	**Video (Std)**	**Paper (Std)**	Significant Difference
Lecture v. Video	3.60 (0.81)	3.91 (0.79)	-	***
Lecture v. Paper	3.60 (0.81)	-	3.28 (0.92)	***
Video v. Paper	-	3.91 (0.79)	3.28 (0.92)	***

Significance of Correlations: *p<0.050, **p<0.010, ***p<0.001

Discussion

Learning ERP systems could be challenging due to the poor usability of their interfaces. Thus, teaching methods for ERP systems must bring these challenges into account when instructions are prepared. The objectives of this study are to understand students' perceptions of and intention to use three types of multimedia teaching methods (the lecture, the video-based tutorial, and the paper-based tutorial) for the SAP ERP system and the difference in the relationship among these perceptions and intention to use one teaching method to another. For the first time, this study finds that the original TAM is applicable to explain students' intention to use the multimedia teaching methods for the SAP ERP system.

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The standardized total effects of the path analysis revealed several findings. Att did not have a strong influence on BI. Instead, BI was mainly impacted by direct influence from PEOU and PU across the three structural models. This finding is supported by the explanation from Venkatesh et al. (2003) regarding the spurious relationship between Att and BI. The path analysis also reveals that the standardized total effects of PEOU on BI (0.69 for the lecture, 0.67 for the video-based tutorial, and 0.76 for the paper-based tutorial) are higher than the standardized total effect of PU on BI (0.41 for the lecture, 0.50 for the video-based tutorial, and 0.40 for the paper-based tutorial) across the three structural models. This finding indicates that PEOU is a stronger predictor of BI than PU across the three structural models. There are two possible reasons for this finding.

First, when users were trained to use a particular system for the first time, the experience from the training influenced their judgment of the ease of using the system (Venkatesh & Davis, 1996). In the context of this study, when students experienced using each multimedia teaching method for an SAP ERP hands-on exercise for the first time, they assessed how easy it was to understand and follow the multimedia teaching method. This analysis is supported by the finding from students' keyword feedback shown in Table 3. Most of the students' keyword feedback across three multimedia teaching methods mainly focused on how easy the multimedia instructions were to follow (e.g., clear, easy to follow) and how easy the teaching methods were to use (e.g., in-class support, easy to use videos, easy to use papers, and pace).

Second, the fact that PU was a weaker predictor of BI than PEOU across the three structural models may also be because students perceived that the multimedia teaching methods caused lower productivity and lowered their learning performance. Table 3 reveals several students' perceptions of inefficiencies of the multimedia teaching methods. Many students found the lecture too slow, and they lost interest easily. Several students perceived the video-based tutorial as too slow and had too many videos. The paper-based tutorial also caused students anxiety because they were not sure whether they interpreted the instruction correctly. Several students also felt the paper-based tutorial required too much reading.

A comparison between the standardized total effects of PEOU and PU on BI across the three structural models shows that the video-based tutorial's standardized total effect of PU on BI (0.50) is higher than those of the other models (0.41 from the lecture and 0.40 for the paper-based tutorial). By comparing the standardized total effects of PU and PEOU on BI across three multimedia teaching models, the study finds that the difference between the standardized total effects of PU and PEOU on BI from the video-based tutorial (0.50 and 0.67) is a lot less than those from the lecture (0.41 and 0.69) and the paper-based tutorial (0.40 and 0.76). These findings indicate that PU plays quite a significant role in influencing BI in the video-based tutorial. Additionally, the influence of PU on BI in the video-based tutorial is stronger than those in the other teaching methods.

The mean comparison of PEOU and PU across the three multimedia teaching methods also reveals that students perceived the video-based tutorial method as easier to use and more useful than the other two methods. In addition, the lecture was perceived as easier to use and more useful than the paper-based tutorial method (Table 10). To understand a reason behind these findings, the study looks further into students' feedback (Table 2).

Based on student feedback on the video-based tutorial, students perceived the instruction of video-based tutorial as clear, and easy to understand and follow. The video-based tutorial was also easy to use because students could arrange an SAP ERP system screen side-by-side with a video tutorial screen. This screen arrangement allowed them to follow an on-screen demonstration with voice-over instruction easily.

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An ability to pause and rewind the video provided students a sense of control over the pace of exercise. While many students complained about the length of instruction, they may hesitate to fast forward a video or skip certain areas where the instructor explained business aspects to finish an exercise faster because they were afraid to miss steps. As a result, students were likely benefited from learning both operating sequences and underlying business aspects.

As for the lecture, students perceived that the method was easy to use because the instructor was there to guide and motivate them through the whole exercise in person. However, the downside of this method is the pace of exercise, which was determined by how fast the whole class was catching up with the demonstration. Due to the complexity of the SAP ERP system, students rarely followed the ERP exercise demonstration at the same pace. Thus, before the instructor could demonstrate the next step, he had to wait until everyone was ready. One student's misstep could require the whole class to wait until the instructor helped that student. While the instructor had to pause the demonstration and help some students, others may get bored and disengaged. This interruption of the flow of an exercise could be difficult for students to connect operating sequences with underlying business concepts. In addition, some students may feel uncomfortable asking for help because it would interrupt the whole class; thus, they may decide not to continue an exercise and wait until class was over to ask for help.

Students indicated a preference for the paper-based tutorial because they had complete control over the pace of an exercise. Students could quickly scan the content and the format of the instruction. They could also easily scroll up and down the page to find the information they were looking for. Unlike the other two teaching methods, the paper-based tutorial had no live or video demonstration for students to follow. Instead, they had to rely on their interpretation of the text-and-picture-based instruction. This method may cause anxiety for some students. Also, unlike the video-based tutorial, the paper-based tutorial could not deter students from skipping business aspects because students could scan content within a page and choose which area they want to read. Students using a paper-based tutorial finished an exercise in either a short amount of time or the opposite. Students who skipped or paid less attention to business aspects could finish an exercise faster than those who decided to read every part of the tutorial carefully. However, they may also encounter problems in an exercise more often than students who decided to read each section carefully. Based on the instructor's experience providing technical support to students, students who used a paper-based tutorial and tried to rush through the exercise tended to make more mistakes from skipping sections intentionally and unintentionally. As a result, they sought instructor support, which, in turn, caused them to spend significantly more time completing the exercise than they expected.

Implications

This study validates that TAM can be used to explain how students' PEOU and PU influence their BI to use the multimedia teaching methods (the lecture, the video-based tutorial, and the paper-based tutorial) for learning the SAP ERP system. This study found that PEOU had a stronger influence on BI than PU on BI. However, this finding needs to be interpreted carefully. It is possible that after students get used to using the multimedia teaching methods and doing more hands-on exercises, they will start focusing more on the learning performance. Additionally, a learning motivation may play a role in the study outcome. Students were aware that the SAP ERP exercises were meant for teaching them to be familiar with the SAP ERP system, not to develop in-depth SAP ERP skills and knowledge. Thus, their intention to use the multimedia teaching methods for learning the SAP ERP system was driven more by the ease of using the teaching methods and following the instructions to finish the exercises. The easier it is to understand and follow the multimedia instruction, the easier it is to

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complete the SAP ERP exercises. If a class's learning objective had been to develop in-depth SAP ERP skills, PU would likely have a stronger influence on students' BI than the current findings. This study also found that Att had little effect on BI. Thus, a future study of learners' acceptance of the multimedia teaching methods for the ERP systems may exclude Att from the original TAM.

The feedback from students also provided insight into how students perceived each multimedia teaching method. The video-based tutorial showed a stronger balance between PEOU and PU in influencing BI than the lecture and the paper-based tutorial methods. This finding may suggest that the video-based tutorial would be suitable for an SAP ERP exercise with complex operating sequences and underlying business aspects. While this method would be an ideal method for teaching the SAP ERP system, it should be used thoughtfully. Since it is easy for learners to follow a video demonstration step-by-step, they may passively follow without understanding the operational sequences and their meanings. To prevent the passivity issue, an instructor may use a quiz between steps/video clips so students would follow a video demonstration mindfully.

Like the video-based tutorial, the lecture is easy to follow since the instructor guides students through the whole exercise. The challenge for instructors is to keep everyone at the same pace. No matter how well the instructors prepare the instruction, it is inevitable that students would make missteps. The longer students wait for their classmates to keep up, the less attention they could maintain. Thus, the lecture would be more suitable for a short exercise with simple operating sequences and underlying business concepts to minimize students' chances of losing their attention and making errors. In addition, the fact that an instructor is in a classroom with students may ease students' anxiety from using the ERP systems because students know they could find support from the instructor. Therefore, this teaching method would also be suitable for the first SAP ERP exercise, in which students' anxiety would be high from using SAP ERP for the first time.

Unlike the lecture and the video-based tutorial, which allows learners to follow a demonstration with minimum effort of learners' interpretation, the paper-based tutorial requires learners to interpret the text-and-screenshot-based instruction. Using it mindfully, learners can enhance their SAP ERP skills and understanding of underlying business concepts. Moreover, the paper-based tutorial allows students to have complete control over the pace of an exercise. Students can scan through each page and understand the format/layout of an instruction. Students can move through the exercise at their own pace, which means they can choose to pay attention to specific content and skip others. Thus, the paper-based tutorial would be suitable in two situations. The paper-based tutorial would be an effective method when it is used for a short and straightforward SAP ERP exercise. This suggestion also means that the paper-based tutorial should be avoided when an exercise has lengthy and complicated explanations about business concepts. The paper-based tutorial could also be used together with the video-based tutorial. When the video-based tutorial is used for a long and complicated exercise, the paper-based tutorial could be used for a simple/routine part of the exercise by allowing learners to complete the exercise faster. The paper-based tutorial method could also be used for a short and complex exercise, but a quiz should be added between sections to encourage students to pay attention to business concept explanation.

Regardless of the multimedia teaching methods instructors plan to use and how they plan to use these, multimedia instruction must be designed carefully to ensure that it is clear, easy to understand, and easy to follow. Our study used Mayer's (2014) twelve multimedia instructional design principles to prepare the SAP ERP tutorials. Other multimedia instructional guidelines can also help instructors prepare ERP tutorials (e.g., Van der Meij & Van der Meij, 2014; Halpern; 1988; Horton, 1991; Lazonder,

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1994). After a multimedia tutorial is designed, it should be tested with learners and refined according to their feedback.

Future Research Opportunities

Future research should examine antecedents of students' PEOU and PU and how these antecedents affect them in different multimedia teaching methods. Student feedback implied that students seemed to have different levels of confidence and anxiety toward different multimedia teaching methods. For example, students seemed to feel unsure and anxious about whether they interpreted the paper-based tutorial correctly. In contrast, students seemed to feel more comfortable following the video-based tutorial and the lecture. Future research should investigate how students' anxiety toward the ERP systems and computer self-efficacy affect PEOU and PU in different multimedia teaching methods. Another research opportunity is to investigate how different multimedia teaching methods affect learners' intention to use ERP systems. Studies already show that training plays an essential role in influencing users' intention to use ERP systems. This study shows that students do not have the same level of intention to use different multimedia teaching methods for the SAP ERP system. This finding creates another future research opportunity to investigate whether different multimedia teaching methods would have different levels of influence on users' intention to use the ERP systems.

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Appendix A:

Mayer's (2009) Twelve Multimedia Instructional Design Principles

Managing Essential Processing	
Principle	**Explanation**
Segmenting principle	We learn more deeply when a multimedia lesson is presented in learner-paced segments rather than a continuous presentation.
Pre-training principle	We learn more deeply when we learn about key components' names/characteristics in a multimedia lesson before the lesson is introduced to us.
Modality principle	We learn more deeply from pictures with narration than pictures with printed text.
Reducing Extraneous Processing	
Principle	**Explanation**
Coherence principle	We learn more deeply when extraneous material is not included in a multimedia lesson.
Signaling principle	We learn more deeply when cues are used to call for attention to important areas of a lesson.
Redundancy principle	We learn more deeply from pictures with narration than pictures with narration and on-screen text.
Spatial Cognitive principle	We learn more deeply when corresponding printed texts are presented near graphics than far from each other.
Temporal Cognitive principle	We learn more deeply when corresponding pictures and narration are presented simultaneously rather than successively.
Fostering Generative Processing	
Principle	**Explanation**
Personalization principle	We learn more deeply from a multimedia message when words are in a conversational style.
Embodiment principle	We learn more deeply when on-screen agents use human-like body language, eye contact, and facial expression.
Voice principle	We learn more deeply when a message is narrated by a human voice rather than a machine voice.
Image principle	We do not necessarily learn more deeply when an instructor's image is on the screen.

Appendix B:

Construct Items of PEOU, PU, Att, and BI

Constructs	**Items/Questions**
PEOU	**[L = Lecture] / [V = Video-based tutorial] / [P = Paper-based tutorial]**
PEOU1	I would find the [L] / [V] / [P] for hands-on SAP ERP exercises easy to use.
PEOU2	The [L]'s / [V]'s / [P]'s instruction for hands-on SAP ERP exercises is clear, easy to understand and follow.
PEOU3	Learning to follow the [L] 's / [V] 's / [P] 's instruction for hands-on SAP ERP exercises would be easy for me.
*PEOU4	I would find the [L] / [V] / [P] for learning hands-on SAP ERP exercise to be flexible to interact with.
PU	
PU1	Using the [L] / [V] / [P] would make it easier to do hands-on SAP ERP exercises.
PU2	Using the [L]'s / [V]'s / [P]'s instruction makes it easier to operate the SAP ERP system to complete hands-on exercises.
PU3	Using the [L] / [V] / [P] would improve my performance in SAP ERP exercises.
*PU4	Using the [L] / [V] / [P] would enable me to accomplish hands-on SAP ERP exercises more quickly.
Att	My experience with the [L] / [V] / [P] method for SAP ERP hands-on exercises was…
Att1	Unpleasant – Pleasant
Att2	Worthless - Valuable
Att3	Bad - Good
*Att4	Foolish - Wise
BI	
BI1	I intend to use the [L] / [V] / [P] to learn how to the SAP ERP system in the future.
BI2	When I use the SAP ERP system, I plan to use the [L] / [V] / [P] to learn how to use the system.
BI3	I predict that I would use the [L] / [V] / [P] to learn how to use the SAP ERP system.

*Removed item

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