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A PROPOSED FRAMEWORK TO UNDERSTAND THE INTRINSIC MOTIVATION FACTORS ON UNIVERSITY STUDENTS' BEHAVIORAL INTENTION TO USE A MOBILE APPLICATION FOR LEARNING

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ABSTRACT

Aim/Purpose	By integrating a motivational perspective into the Technology Acceptance Model, the goal of this study is to empirically test the causal relationship of intrinsic motivational factors on students' behavioral intention to use (BIU) a mobile application for learning.
Background	Although the Technology Acceptance Model is a significant model, it largely remains incomplete as it does not take into consideration the motivation factors and/or outside influences in the adoption of new technology.
Methodology	A Mobile Application Motivation Instrument (MAMI) was developed from a comprehensive review of literature on intrinsic motivation and verified using a formalized card sorting procedure. Four intrinsic motivation scales were developed: perceived competence (COM), perceived challenge (CHA), perceived choice (CHO), and perceived interest (INT). Consequently, a scale to assess students' behavioral intention (BIU) to use mobile applications was developed using existing scales from prior TAM instruments.
Contribution	Incorporating the motivational factors into TAM may provide better explanation and prediction of student acceptance and usage of mobile applications. A potential contribution of this study is the development of a reliable and valid instrument that could be further used by a growing community of researchers, instructional designers, and instructors.
Findings	Data were collected from 193 participants to test the causal relationship of perceived competence (COM), perceived challenge (CHA), perceived choice (CHO), and perceived interest (INT) on students' behavioral intention to use (BIU) a mobile application, using a structural equation modeling approach. The structural path model indicated that perceived compe-

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tence (COM), perceived challenge (CHA), perceived choice (CHO), and perceived interest (INT) had a significant influence on students' behavioral intention to use (BIU) a mobile application for learning. Implications of this study are important for researchers and educational practitioners.

Future Research One environmental dimension, understudied but with likely implications for intrinsic motivation, is the social environment.

Keywords intrinsic motivation, mobile learning, behavioral intention, competence, challenge, choice, interest

INTRODUCTION

The utilization of mobile applications (apps) has the potentiality to alter the view on the learning landscape and the methods in which student learning is supported through distinct approaches to learning (Godwin-Jones, 2011; Rossing, Miller, Cecil, & Stamper, 2012). The question of how learners interact with mobile apps is complex (Christensen & Prax, 2012). A number of studies have demonstrated the successful use of mobile technology to enhance and support student learning, especially in the area of social networking and communication (Jones, Scanlon, & Clough, 2013; Sharples, Arnedillo-Sánchez, Milrad, & Vavoula, 2009). Learning through the use of mobile technology should never entirely substitute classroom or alternative approaches to technology-supported learning options (Tabor, 2016). However, if harnessed appropriately, mobile technology can transform and subsequently enrich learning styles or behavior in positive ways. Furthermore, the utilization of mobile devices offers students the added convenience in terms of how, when, and where learning can occur. Consequently, this will have a profound effect on educational systems, bringing about more advanced opportunities on information technology and the way in which educators will have to gradually transform their teaching practices in ways that are more conducive to ubiquitous learning environments.

A mobile application, most commonly referred to as an 'app', is a type of application software designed to run on a mobile device, such as a smartphone or a tablet computer (Keyes, Shroff, & Linger, 2013). Apps can take different forms, such as an e-book, a game, flash cards, guided media, or an interactive animation (Geist, 2011). Apps designed to reinforce concepts from learning content can be very effective (Keyes, Shroff, & Linger, 2013). Additionally, the affordability and ubiquity of mobile apps has contributed to the increasing attention given to learning (Garcia-Cabot, de-Marcos, & Garcia-Lopez, 2015). For a mobile application to be pedagogically meaningful, it needs to conform to various requirements: (1) the app should address specific pedagogical issues that may be hard to address in the classroom; (2) the overall design of the app must be carefully thought out and be enjoyable to use, and aesthetically appealing in order for it to contend within the mobile ecosystem of other apps; and (3) the value of the content of the app and the way in which it will be utilized and/or assessed in the context of a course must be made clear to the student. Any of obstructions in the way of these necessary elements may cause the production of the app a waste of time, effort and/or resources. Subsequently, the use of mobile apps presents an opportunistic niche to effectually deal with the complex and important phenomenon of assessing which factors may be responsible for supporting student intrinsic motivation.

Research indicates that although large investments have been made in developing mobile applications for learning, many of these applications have been not been fully utilized or neglected completely, due to a number of reasons such as users' requirements not being met and taken into consideration (Liu, Liao, & Pratt, 2009; Teo, 2009). The prevalence of mobile learning can be denoted as not only dependent on technology enhancement, but also user adoption or user behavioral intention to use (BIU). Several notable theories related to psychology, including the Technology Acceptance Model (TAM) (Davis, 1989), and the Unified Theory of Acceptance and Use Technology Model (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) have been introduced to predict user actions and behaviors. Furthermore, the TAM is a widely accepted model that proposes to examine the determinants of user acceptance of information technology through quantitative inquiry. In addition, the TAM has been put to practical use and subsequently validated in research studies on different mobile applications, such as mobile games, mobile testing, mobile cloud services and mobile map services (Alharbi, 2012; Hsu & Lu, 2004; Zhou, 2011). Subsequently, the TAM and its extended models are much related with studies on behavioral intention to use (BIU).

Background and Theoretical Framework

Although the TAM is a significant model, it largely remains incomplete as it does not take into consideration the motivation factors and/or outside influences in the adoption of new technology. Subsequently, the TAM has been modified and adapted by researchers that later proposed extended models of the TAM like Technology Acceptance Model 2 (TAM2), Unified Theory of Acceptance and Use Technology Model (UTAUT) and Technology Acceptance Model 3 (TAM3). The extended models of the TAM added several determinants with the purpose of providing a more comprehensive model structure. The comparison of the determinants for these models is shown in Table 1. For example, the C-TAM-TPB model is the merging of the distinct Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB).

Table 1. The determinants of TAM and its extended models

TAM (Davis, 1989)	**TAM2** (Venkatesh & Davis, 2000)	**UTAUT** (Venkatesh et al., 2003; Wu, Tao, & Yang, 2008)	**TAM3** (Venkatesh & Bala, 2008)	**C-TAM-TPB** (Venkatesh et al., 2003)
▪ Actual system used (ASU)	▪ Actual used	▪ Actual used	▪ Use behavior	▪ Attitude toward behavior
▪ Attitude toward using (ATU)	▪ Behavior intention (BI)	▪ Behavioral intention (BI)	▪ Behavior intention (BI)	▪ Subjective norm
▪ Perceived usefulness (PU)	▪ Perceived usefulness (PU)	▪ Performance expectancy	▪ Perceived usefulness	▪ Perceived behavioral control
▪ Perceived ease of use (PEOU)	▪ Perceived ease of use (PEOU)	▪ Effort expectancy	▪ Perceived ease of use	▪ Perceived usefulness (PU)
	▪ Subjective norm	▪ Social influence	▪ Subjective norm	
	▪ Role of image	▪ Behavior Facilitating Conditions	▪ Image	
	▪ Role of job relevance	▪ Gender	▪ Job relevance	
	▪ Output quality	▪ Age	▪ Output quality	
	▪ Results demonstrability	▪ Experience	▪ Results demonstrability	
		▪ Voluntariness	▪ Computer self-efficacy	
			▪ Perceptions of external control	
			▪ Computer anxiety	
			▪ Computer playfulness	
			▪ Perceived enjoyment	
			▪ Objective usability	
			▪ Experience	
			▪ Voluntariness	

However, what had been missing until recently is an instrument that measures student intrinsic motivation factors but also the effect these factors have on students' behavioral intention to use (BIU) a mobile application for learning. In the context of student acceptance of mobile applications, we believe intrinsic motivation factors also play a key part in trying to explain user acceptance and usage. To address this need, the objective of this study is to test the causal relationship of perceived competence (COM), perceived challenge (CHA), perceived choice (CHO), and perceived interest (INT) on students' behavioral intention to use (BIU) a mobile application, i.e., the degree to which the individual (i.e., student) has worked out an informed potential strategy to execute or not execute the respective future behavior (Punnoose, 2012). Incorporating the motivational factors into the TAM may, therefore, provide better explanation and prediction of student acceptance and usage of mobile applications. Moreover, a potential contribution of this study is the development of a reliable and valid instrument that could be further used by a growing community of researchers, instructional designers, and instructors.

Over the years, there has been a major change towards facilitating motivating learning settings and the development of mobile learning initiatives that nurture and support motivation. The consequence of mobile technology onto the learning stage and its influence on students has led to a significant need for research of motivation in respect to mobile applications. When students use mobile apps as a learning tool, they are in an active role, as opposed to a passive role of recipient of information exchanged and delivered by the instructor. The students are increasingly making choices in respect to generating, obtaining, manipulating, or displaying information. The app enables them to actively interact with the content, make choices in respect to navigation, and practice skills compared to traditional face-to-face classroom settings. However, a significant problem in the context of mobile learning (m-learning) is that not much is understood about the impact of mobile apps on student intrinsic motivation. Prior research on intrinsic motivation has primarily been related to assessing student intrinsic motivation in a conventional face-to-face classroom environment (Dornyei, 2000; Shroff, Vogel, Coombes, & Lee, 2007). In regard to mobile learning, however, research focusing on students' intrinsic motivation is fragmented and provides little direction. A more thorough review of the cognitive and affective aspects of intrinsic motivation and the capacity to evaluate students' intrinsic motivational behavior while interacting with mobile applications, promises to fuel fresh insights into the design and build of more compelling applications and thus ultimately to greater learning outcomes and achievement.

Intrinsic motivation exerts a crucial influence on learning achievement, satisfaction, and learners perceptions on performance expectations (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). As a result, the student appropriates various motivational strategies that are based on his or her own knowledge, skills and experiences. Through a greater understanding of intrinsic motivation, educators are able to focus on applying teaching methods, styles, and learning environments that promote student intrinsic motivation. Therefore, it is imperative that we better understand the implications of mobile applications on factors supporting individual student intrinsic motivation. The research by Deci and Ryan (1980) directed the selection of applicable factors for our research model. For this reason, our research model is developed on a motivational model that draws elements from the Self-Determination Theory and the Technology Acceptance Model (TAM) (Davis, 1989; E. L. Deci & Ryan, 2016).

Perceived Competence

Competence is the ability to be effective in the environment that results from the accumulated outcomes of an individual's transactions in his or her environment (Bouffard, Marcoux, Vezeau, & Bordeleau, 2003). It provides information about the tasks and activities achievable by an individual and which of these interactions and activities are worth undertaking (Buch, Säfvenbom, & Boe, 2015). As such, perceived competence is an individual's awareness and comprehension of his or her own capabilities (Froiland & Oros, 2014). For example, using a mobile app for learning may support individual, technical, and cognitive skills that form an individual learner who feels competent and compelled to achieve. Consequently, perceived competence refers to the perceived capacities that an individual possesses, thereby leading to success in his or her tasks, activities and assessments (Nikou & Economides, 2017). In this model, perception of competence is the amount of effort expended in pursuing a learning activity as well as an individual's cognitive skills required to effectively interact. This engagement constitutes a critical component of an individual's expectations for success at a given task (Hagger, Koch, & Chatzisarantis, 2015).

Perceived Challenge

Although a significant body of research has demonstrated the positive effects of challenging tasks or activities on intrinsic motivation, limited research has examined the subjective experience of an individual's perceptions of how challenged he or she is whilst engaged with mobile technology (Cox, Cairns, Shah, & Carroll, 2012; Kim, Kim, & Wachter, 2013). Research has shown perceived challenge to be a critical factor in supporting intrinsic motivation (Abuhamdeh & Csikszentmihalyi, 2012a; Abuhamdeh, Csikszentmihalyi, & Jalal, 2015). The extent to which an individual feels challenged in a mobile app learning activity may depend, in part, upon the nature of the interactivity experienced by the individual user and by the mobile learning environment created by the app itself (Hamari et al., 2016). In summary, Deci and Ryan's (1980) Self-Determination Theory (SDT) provides a sound framework to examine the construct of individual perceived challenge. An individual subsequently feels challenged when he or she perceives the challenge(s) of the task to be balanced with his or her ability to perform the task(s) (Abuhamdeh & Csikszentmihalyi, 2012b). For example, when an individual finishes a challenging task, they may be given textual feedback or a score that assesses their performance. The individual may also be given some form of indication of how skillful he or she has been on the given challenge (Chen & Law, 2016). This happens by way of a gain in points and an advancement in terms of level/difficulty of the game. Therefore, using rewards can increase motivation and the drive to succeed in a game (Mekler, Brühlmann, Tuch, & Opwis, 2017). One significant feature design of the app includes the utilization of a reward system in which points are attained for correct responses. Correspondingly, the reward mechanism (i.e., scoring of points) implies the numbered levels of increasing difficulty attained by each player (Deen & Schouten, 2011). For example, the reward feature built into the design of a mobile app, not only provides instructive information instantly to the player regarding a correct answer, but also allows the player to appropriately acknowledge a correct response. Hence, an individual may be challenged when they perceive the challenge to be balanced with their ability to do the task.

Perceived Choice

Perceived choice conveys the subjective experience an individual feels during behavior that results in autonomous versus controlled engagement (Reeve, Nix, & Hamm, 2003). As a motivational construct, the construct of choice is only applicable when an individual has the freedom to exercise choice and has control in regard to their action (Markland, 1999). From a motivational perspective, the capacity to make a choice implies the capacity to take action or not, which may prompt that individual to encounter a feeling of control (Reeve et al., 2003). Hence, engagement with a mobile apps offers students choice over they monitor and regulate their behavior. For example, the design of an app may take on two formats. The first format is linear, whereby the user, after producing a certain response, receives a reward and then moves forward onto the next clue. The second format entails branching – this is where the next clues to be confronted with will depend upon the action performed by the user, meaning that no two users will follow the exact same pathway through their learning experience. Based upon these two formats, the user can opt for a number of other ways to make progress in the game, by making selective choices based on their individual abilities and learning styles (Gee, 2003). Within the context of a mobile app for learning, we expect that the provision of choice is likely to be presented as a choice over options and actions (Shroff, Trent, & Ng, 2013).

Perceived Interest

In a learning environment, it is presumed that individual perceived interest can encourage an individual to use prior knowledge in pursuing new knowledge and motivate the individual to engage in various learning activities (Chen & Law, 2016). Theoretical implications and research findings have supported these arguments and have clarified the construct of perceived interest in a learning environment both conceptually as well as empirically (Lin & Huang, 2016; Renninger, 2000). Perceived interest is defined as a positive psychological state that is based on or emerges from individual-activity interaction (Flowerday & Shell, 2015). It is an important motivational construct that is "central in determining how we select and persist in processing certain types of information in preference to others" (Hidi, 1990). Thus, an individual who is interested in a task (due to personal interest) might be motivated to complete it well. Similarly, an individual who is interested in a task expends more effort (Schiefele & Krapp, 1996), spends more time on the task (Wade, Schraw, Buxton, & Hayes, 1993) and processes the information on a deeper level (Venkatesh, 2000). Hence, the use of a mobile app for learning may increase individual perceived interest because the activities of engaging with the app, for example, may evoke satisfaction and subsequently engage the attention of an individual.

Moreover, research indicates that although large investments have been made in developing mobile applications for learning, many of these applications have been underutilized or abandoned completely due to limited user acceptance (Liu et al., 2009; Park, 2009; Teo, 2009). A number of models have been extensively studies over the past three decades to examine factors that a direct effect on individuals' technology acceptance (Agarwal & Prasad, 1988; Morris & Dillon, 1997; Thompson, Compeau, & Higgins, 2006). The Technology Acceptance Model (TAM) proposed by Davis (1989) is the classical information systems (IS) model developed to explain computer-usage behavior and factors associated with acceptance of technology. Behavioral intention to use (BIU) is a key construct that ascertains whether a user will in fact utilize the mobile app or not.

Technology Acceptance – Behavioral Intention to Use

Understanding an individual's behavior for using various information technology systems and tools has been an important topic of research since the mid-1970s. Intention to use is derived from behavioral intention and is defined as "the strength of one's intention to perform a specified behavior" (Fishbein & Ajzen, 1975). Research studies on TAM have shown that behavioral intention has a positive effect on behavior (Lu, Lin, & Chen, 2017). Davis, Bagozzi, and Warshaw (1989) noted that usage is significantly correlated to behavioral intention to use, and that behavioral intention is a significant determinant of user behavior in technology acceptance. Moreover, Hill, Smith, and Mann (1987) postulated that behavioral intention is a significant predictor of action. To summarize, previous research has shown that behavioral intention to use the system is both a valid and reliable measure of system usage in the future. Prior studies also indicated that the various constructs affecting behavioral intention to use a system is indicative of our understanding of their intent in the analysis, design and implementation of information systems (Guo, Goh, Luyt, Sin, & Ang, 2015; Pituch & Lee, 2006; Saadé, Tan, & Nebebe, 2008).

Moreover, the growing basis of technology acceptance is significant to ensuring that the mobile application is effectively used by students. Application of the TAM model would seem to be favorably indicated for understanding conceptual issues related to mobile app use. For example, the behavioral intention to use (BIU) factor in the TAM model constitutes the subjective likelihood that using the mobile application will increase the users performance (Davis, 1989; Gao, 2005). Specifically, we want to try to better understand how intrinsic motivational factors support technology acceptance in the context of mobile apps, based on the following assumptions:

1. When students exercise skill or mastery using the app, they may have a favorable intention towards using the app;
2. When students find engaging with the content challenging (i.e., testing their ability), they may have a favorable intention towards using the app;

3. When students exercise choice as to how much they engage with the app or make selections within the app, they may have a favorable intention towards using the app;
4. When students exhibit interest or the app holds their attention, they may have a favorable intention towards using the app.

RESEARCH HYPOTHESES

Based on the research objective and consistent with the related literature, this study tested the following hypotheses:

> H^1: Perceived competence (COM) will have a significant influence on students' behavioral intention (BIU) to use a mobile application for learning.
>
> H^2: Perceived challenge (CHA) will have a significant influence on students' behavioral intention (BIU) to use a mobile application for learning.
>
> H^3: Perceived choice (CHO) will have a significant influence on students' behavioral intention (BIU) to use a mobile application for learning.
>
> H^4: Perceived interest (INT) will have a significant influence on students' behavioral intention (BIU) to use a mobile application for learning.

The hypotheses stated above give rise to the research model (Figure 1) represented as a causal relationship schema and used as a point of departure for this research. The boxes represent the constructs which were measured by a set of items, with arrow diagrams to represent hypotheses 1 to 4.

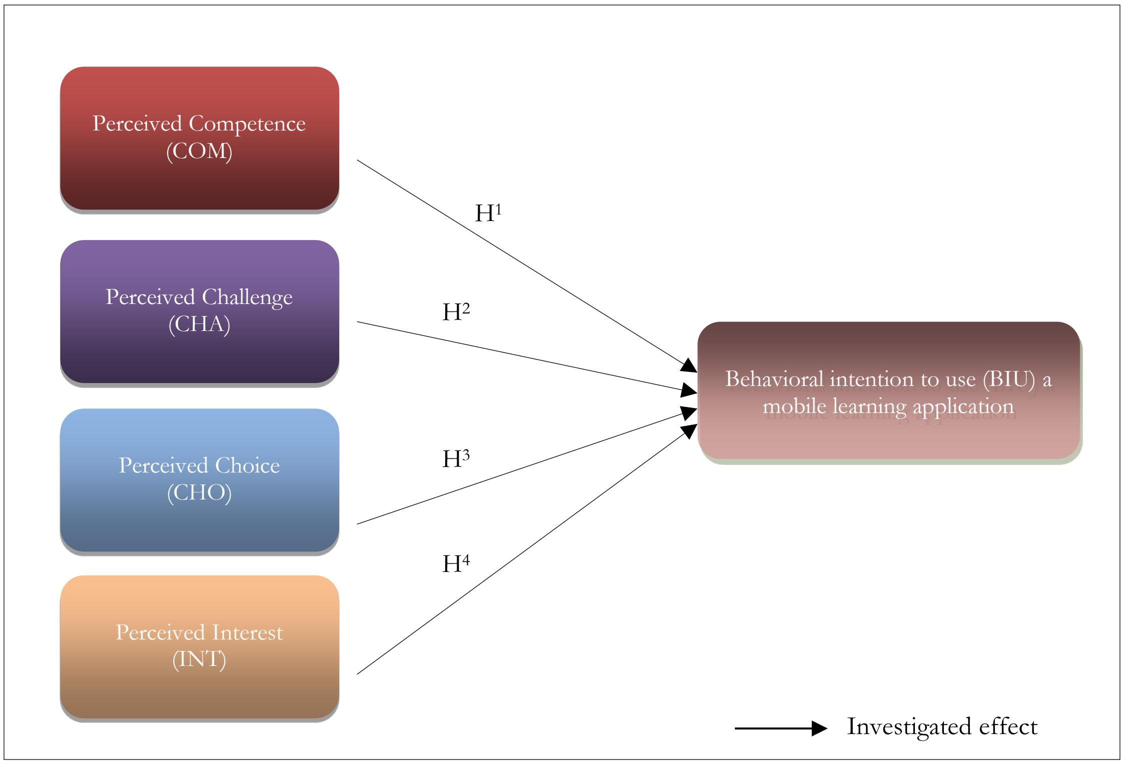

Figure 1. Conceptual research model

RESEARCH METHODOLOGY

INSTRUMENT DEVELOPMENT PROCESS

The Moore and Benbasat (1991) development procedure was utilized to create and test the survey instrument, since this instrument development process provides a high degree of confidence in the constructs and item content as well as construct validity and reliability. The following 3-stage development process was used: 1) Item creation – creating a pool of items to match each construct definition. The objective of this stage was to ensure content validity, 2) Card Sorting – using a total of four judges in multiple rounds to sort items into construct categories (scales), and then, examining judges' inter-rater reliabilities and their consistency of labelling these scales, and 3) Instrument testing – administering the survey instrument to a small scale pilot sample with the objective of checking scale reliability.

Item creation

The intent of the item creation step was to ensure content validity of the measurement items, by making sure the survey instrument covers all of the items, adequately reflecting the meaning of each of the constructs that are put forward to form part of the conceptual framework (see Figure 1) (Bohrnstedt, 1970). The items for the instrument were generated from the framework and literature described earlier. Firstly, an initial item pool for the respective constructs were generated. Secondly, items that were considered to be too narrow in focus and which applied only to a specific circumstance were subsequently withdrawn. After the item pools were constructed, they were then re-examined to discard those which seemed to be unclear or problematic (i.e., not able to load on more than one construct).

Card sorting

The second stage of the card sorting procedure comprised of two parts: 1) to assess the construct validity of the measures being developed in accordance with the theoretical assumptions and concepts of our framework, and 2) with the purpose of identifying, eliminating or rewriting any particular items which still may be considered ambiguous (i.e., fitting in more than one category). To successfully reach these goals, four judges were selected to arrange the respective items into construct categories by ranking how well the items fit in their respective construct definitions. In the first round the judges were not told what the labels or names of the underlying constructs were, but were instead asked to provide their own labels and definitions for the constructs. In the second round the judges created a matric with construct definitions at the top of the columns and items listed as the rows and were instructed to sort the cards into the five predefined categories. Hence, confidence in the construct validity of the scales increased if the judges' definitions matched the scale's intent.

To assess the reliability of the sorting conducted by the judges, we used two different measurements. First, we measured the level of agreement in categorizing all 20 items and five categories of items across all four judges at one time, using Cohen's Kappa (Maxwell, 1970). In the first round the Kappa scores averaged 0.85. The Kappa coefficient value of 0.95 was higher than the value obtained in the first round, thereby strongly suggesting an excellent fit, formed on the recommendations of Landis and Koch (1977) for explaining the Kappa coefficient.

A second measurement of validity and reliability was an Item Placement Ratio which measured how many items were placed by the panel of judges for each round within the 'target' construct. This meant that we were able to measure the overall frequency with which the judges placed items within the intended theoretical constructs. Hence, the five theoretical constructs comprising of four items were developed for each construct. With a panel of four judges, a theoretical total of 16 placements could be made for the five constructs. A matrix of item placements for the first round was created as shown in Tables 2 and 3 (including an ACTUAL "N/A: Not Applicable" column whereby the judges were able to allocate items which they perceived did not fit any of the categories).

Table 2. Matrix of item placement – judge's classification of first round

	Perceived Competence (COM)	Perceived Challenge (CHA)	Perceived Choice (CHO)	Perceived Interest (INT)	Behavioral Intention to Use (BIU)	N/A	TO-TAL	% Hits
Perceived Competence (COM)	**16**	0	0	0	0	0	16	100
Perceived Challenge (CHA)	0	**13**	1	2	0	0	16	81
Perceived Choice (CHO)	0	1	**14**	1	0	0	16	87
Perceived Interest (INT)	1	0	1	**13**	1	0	16	81
Behavioral Intention to Use (BIU)	0	0	0	0	**15**	1	16	93
Item Placements: 80		Hits:71			Overall "Hit Ratio": 89%			

A review of the diagonal matrix (Table 2) illustrates that with a theoretical maximum of 80 placements (five constructs at 16 placements), a total of 71 "hits" was achieved, for an overall placement "hit ratio' of 89%. Furthermore, an analysis of each of the rows indicates how the items generated to appropriate the particular constructs are arranged according to their shared characteristics. For example, the "Perceived Competence" row indicates all 16-item placements were inside the range of the target construct, but that in the "Perceived Challenge" and "BIU" row, only 81% (13/16) and 93% (15/16) respectively, were within target. Hence, attention was given to those items that were "off-diagonal" and any items that were vague, poorly worded or tapped a non-intended construct were identified. Depending on the placements put together by the judges, the items were re-examined and any ambiguous or unsuitably worded items (i.e., fitting in more than one category) were subsequently reworded or rephrased. The re-worked items were next subjected to a second round with an entirely new lot of four judges. Thus, a second round of item placements was considered necessary in helping us to further interpret and refine the items and constructs of the instrument (see Table 3).

Table 3. Matrix of item placement – judge's classification of second round

	Perceived Competence (COM)	Perceived Challenge (CHA)	Perceived Choice (CHO)	Perceived Interest (INT)	Behavioral Intention to Use (BIU)	N/A	TO-TAL	% Hits
Perceived Competence (COM)	**16**	0	0	0	0	0	12	100
Perceived Challenge (CHA)	0	**14**	0	1	0	0	12	87
Perceived Choice (CHO)	0	0	**16**	0	0	0	12	100
Perceived Interest (INT)	0	1	0	**15**	0	0	12	93
Behavioral Intention to Use (BIU)	0	1	0	0	**15**	0	20	90
Item Placements: 80		Hits:76			Overall "Hit Ratio": 95%			

Examination of the resulting item placement in the second round (Table 3) showed a higher agreement among the judges compared to the first round, indicating a significant improvement in item placement. Hence, the reworded items were accurately matched by all four judges in the second round. This led to an overall hit rate of 95%, demonstrating that all constructs achieved a high item placement ratio, thereby ensuring a high degree of construct validity of the scale (Moore & Benbasat, 1991).

The Research Setting

A total of 1372 (N=1372) undergraduate students enrolled in the course University English II (*GCLA1009*), offered by the Language Centre of Hong Kong Baptist University, constituted a sufficient pool of subjects, who fit well within the intent and objective of this study. The course aims to further improve students' English proficiency in speaking, reading, listening and writing to a more advanced level. The selection of the course was determined by the following. To begin with, the course outcomes (i.e., knowledge of different grammar and vocabulary items) afforded the right set of circumstances for students to interact with a vocabulary crossword puzzle app. Secondly, learning activities in the form of a variety of topics within the vocabulary crossword puzzle app was well structured into the planning and design of the course. In particular, the vocabulary found in the crossword puzzle app appears in the final examination of the course. The courses ran from the Spring semester January to May 2016 over a duration of approximately 12 weeks.

Technology

The "English Vocabulary Crosswords" app (Figure 2) designed and developed by the Resource Centre for Ubiquitous Learning & Integrated Pedagogy (ULIP) for the Language Centre at Hong Kong Baptist University is a game-based mobile app that permits users to review various English vocabulary terms, thereby improving their English language skills. The app is implemented as both an iOS and Android app, and students are able to access this app by simply installing it on their smartphones, just as they do with all their other smartphone applications. The crossword vocabulary app serves a dual role. In one role, the app provides new information (i.e., review of various vocabulary definitions) and in the other role it serves to test the information (i.e., deciphering the correct words). The app was specifically designed to allow users to achieve success by building up their existing vocabulary word bank on a variety of vocabulary topics such as people and ideas, law and society, and arts and entertainment (Figure 3). The crossword exercises are comprised of a format in which the players are provided with the definitions of words. Learning the definitions of words can be a valid and practical way to increase their vocabulary and, by the same token, players can learn the instances and contexts in which the words can be used.

Fundamentally, the app was designed based upon the concept of mastery, meaning that in order to exhibit knowledge and understanding of a word, it must be correctly solved in the cross-word grid (see Figure 4). Thus, this app demonstrates that an immersive game-based app allows for active inquiry and exploration in a defined space. Furthermore, when developing their vocabulary, students benefit from an app that provides contextualized, authentic learning opportunities and engages them in tasks where they use words to communicate in meaningful ways.

Screen layouts of the iOS version of the mobile app running on an iPhone are shown in Figures 2-7. The user-interface design and each of the five crossword puzzle games are consistent in color scheme, font, and layout. This assists a player by providing consistency in locating specific features and presenting only the required information without a barrage of other distracting items. Moreover, the player is compelled to make finger movements across the screen as he/she is engaged in game play. The touchscreen with zoom function allows the player to react to what is displayed and as a result, control how it is displayed by zooming (i.e. expanding or shrinking the crossword grid). Hand-eye coordination also assists in the development of the skills required to reach the desired goal (Costa & Veloso, 2016). Hence, the need to gather and maintain the player's attention through visual experiences and audio designs is also an important element in the design of this specific crossword app.

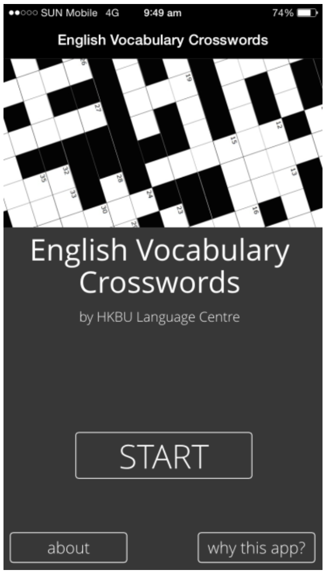

Figure 2

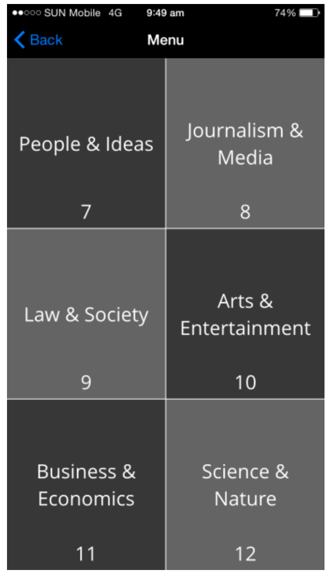

Figure 3

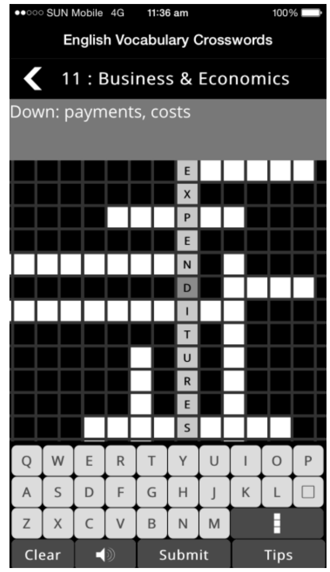

Figure 4

Figure 5

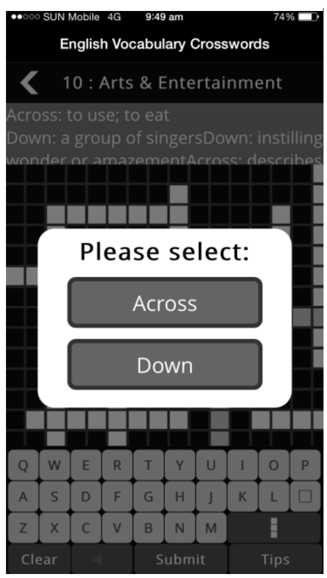

Figure 6

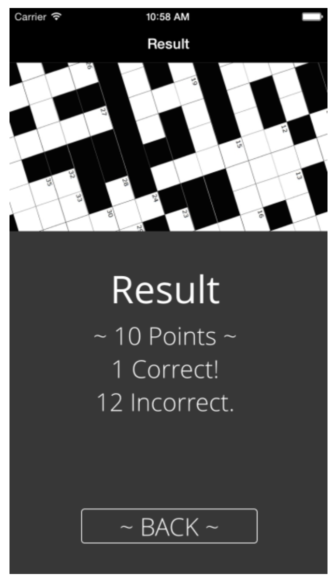

Figure 7

Figures 2-7. English Vocabulary Crosswords – screen layout

MEASUREMENT SCALES

The finalized instrument comprised of two sections (See Appendix). Section I was developed to identify the demographic traits of the respondents. It contained demographic items such as academic year, gender, self-assessment, interaction, and students' experience of mobile app usage. The questions in Section II were constructed from an extensive review of literature on intrinsic motivation and existing scales from prior TAM instruments. Our research model comprised of 20 items (see Table 5) that measured "perceived competence" (4 items), "perceived challenge" (4 items) "perceived choice" (4 items) and "perceived interest (4 items). A scale to assess students' "behavioral intention to use a mobile application" (4 items) was put together from the TAM scales, adapted from Davis et al. (1989) and Venkatesh et al. (2003) with the necessary refinements to make them distinctively applicable to mobile app usage. The response scale for all items was a seven-point, positively-packed

Likert scale (Lam & Klockars, 1982) coded as 7: Strongly Agree; 6: Moderately Agree; 5: Slightly Agree; 4: Neither Agree nor Disagree; 3: Slightly Disagree; 2: Moderately Disagree; 1: Strongly Disagree.

DATA COLLECTION

A hard-copy version of the Mobile Application Motivation Instrument (MAMI) was distributed to 1372 students to complete, with the help of instructors facilitating each course, wherein the order of items was randomized. The collection of these questionnaires yielded 193 usable data responses, providing a response rate of 13.78%. A power test was also performed to determine the appropriate sample size necessary to produce a test of the appropriate power. The results demonstrated that a sample size of 193 is adequate to detect, with power equal to .80. With a sample size of 193, the study had a power of 0.792 to yield a statistically significant result, close within the .80, a commonly accepted threshold in these analyses (Cohen, 1977). The data collected from 193 responses was analyzed to present evidence for the validity and reliability of the survey instrument.

RESULTS AND ANALYSES

The analysis process followed the intent of the study. To begin with, validity of model use in the context of the study was analyzed. Having established validity and robust construct relationships, researchers' data results were subsequently analyzed. This was followed by testing of each of the hypotheses by determining the model fit employing various fit indices and assessing the research model.

DESCRIPTIVE STATISTICS

The descriptive statistics of the four factors are shown in Table 4. All means are above the midpoint of 4.00. The standard deviations range from 0.83 to 1.015 indicating a narrow spread around the mean.

Table 4. Summary of means and standard deviations

Factors	Question	Mean	Std#	N*
Perceived Competence (COM)	Q1.	4.969	.8307	193
	Q2.	4.901	.8348	193
	Q3.	4.870	.8430	193
	Q4.	4.792	.9028	193
Perceived Challenge (CHA)	Q5.	4.760	.9237	193
	Q6.	4.776	.9192	193
	Q7.	4.760	.8652	193
	Q8.	4.766	.9108	193
Perceived Choice (CHO)	Q9.	4.880	.8869	193
	Q10.	4.891	.8883	193
	Q11.	4.807	.8679	193
	Q12.	4.781	.9233	193
Perceived Interest (INT)	Q13.	4.807	.9431	193
	Q14	4.802	.9448	193
	Q15.	4.828	.9690	193
	Q16.	4.875	.9124	193
Behavioral intention to use (BIU)	Q17.	4.661	1.0156	193
	Q18	4.797	.9353	193
	Q19.	4.682	.9858	193
	Q20.	4.844	.9303	193

Construct Validity

To test the construct validity of the items in the survey instrument, confirmatory factor analysis was conducted and reliability of factors assessed using Cronbach's (1951) alpha. Construct validity was assessed by employing confirmatory factor analysis (CFA) to test the fit of the data to the model. Table 5 shows the items, constructs and factor loadings of the Mobile Application Motivation Instrument (MAMI) for the sample of 193 students, using the individual student as the unit of analysis. The results of confirmatory factor analysis determined that the scales were not only reliable, but also valid for the factors under study.

Table 5. Constructs, items and loading statistics

Constructs	Items	Factor Loading
Perceived Competence (COM)		
COM1	Using the app for this course enhanced my capability in learning.	.767
COM2	I felt I had sufficient skill to be able to interact with the app for this course.	.849
COM3	I felt I was proficient in using the app for this course.	.867
COM4	I felt I was competent in my performance in using the app for this course.	.813
Perceived Challenge (CHA)		
CHA1	Using the app for this course allowed me to set challenging goals for myself to achieve.	.852
CHA2	I was able to exert the effort to be successful in using the app for this course.	.881
CHA3	I felt my engagement with the app for this course reflected the right balance of difficulty.	.847
CHA4	I felt the app for this course allowed me to generate my own performance goals of variable difficulty.	.830
Perceived Choice (CHO)		
CHO1	I felt like it was my own choice as to how much I engaged with the app for this course.	.795
CHO2	Using the app for this course enabled me to make alternative selections of the different features within the app.	.871
CHO3	I felt that I could decide as to how I navigated through the app for this course.	.870
CHO4	I felt I had discretion as to how I explored details of specific content when using the app for this course.	.824
Perceived Interest (INT)		
INT1	I felt excited about what I was learning using the app for this course.	.867
INT2	I felt the main features of the app stimulated my interest.	.867
INT3	Using the app for this course held my attention.	.871
INT4	Using the app for this course aroused my curiosity to click through and engage with the app.	.859

Constructs	Items	Factor Loading
Behavioral Intention to Use (BIU)		
BIU1	I intend to use the app frequently for my coursework.	.893
BIU2	I intend to continue using the app more in my learning activities.	.884
BIU3	Whenever possible, I intend to use the app as often as needed.	.895
BIU4	I expect my use of the app to continue in the future.	.813

The factors were analyzed using Cronbach's ALPHA (Cronbach, 1951, 1970). All of the measures utilized in this study displayed excellent internal consistency, ranging from 0.842 to 0.895 (see Table 6), thereby exceeding the reliability estimates ($\alpha = 0.70$) recommended by Nunnally (1967).

Table 6. Cronbach ALPHA reliability coefficient

Factor	Items	Alpha
Perceived Competence (COM)	4	**0.842**
Perceived Challenge (CHA)	4	**0.875**
Perceived Choice (CHO)	4	**0.861**
Perceived Interest (INT)	4	**0.889**
Behavioral intention to use (BIU)	4	**0.895**

Convergent and Discriminant Validity

Average Variance Extracted (AVE) of the respective constructs was over the threshold value of 0.50 or higher (J. F. Hair, Anderson, Babin, & Black, 2010). For this model the AVEs ranged from .68 to .76, so all constructs exhibited a high degree of convergent validity. Following Fornell and Larcker (1981), discriminant validity was demonstrated by verifying that the square root of the average variance extracted (diagonal elements in Table 7) is higher than the correlation between constructs (off-diagonal). Hence, the scales utilized in this study adequately fulfilled discriminant validity.

Table 7. Assessment of convergent and discriminant validity

Factor	COM	CHA	CHO	INT	BIU
Perceived Competence (COM)	**.680**				
Perceived Challenge (CHA)	.561	**.727**			
Perceived Choice (CHO)	.432	.554	**.706**		
Perceived Interest (INT)	.516	.545	.499	**.749**	
Behavioral intention to use (BIU)	.452	.656	.513	.628	**.760**

Note: Diagonal values (bold figures) are the square roots of the average variance extracted (AVE). Off-diagonal values are the correlations between constructs.

Table 8 displays a summary of the overall model fit measures. This model was determined to be valid, as indicated by the adequacy indices such as chi-square statistic $\chi 2$ (N = 193) = 289, $p < 0.01$. The chi-square statistic is an intuitive index for measurement goodness-of-fit between data and model. As recommended by Hair, Anderson, Tatham, and Black (1998), several other fit indices are examined. According to Gefen, Straub, and Boudreau (2000) and Hair et al. (1998), goodness of fit index (GFI), comparative fit index (CFI), and normed fit index (NFI) are best if above 0.90 and demonstrate marginal acceptance if above 0.80, adjusted goodness of fit index (AGFI) above 0.80 and root mean square residual (RMR) below 0.05. Furthermore, these fit indices showed that the proposed measurement model revealed a modest fit with the data collected. This study suggests that the model fit was reasonably adequate to assess the results for the structural model. Thus, we could move forward by examining the path coefficients of the structural model.

Table 8. Goodness-of-fit measures

Fit Measures	Values
χ^2	289.297
RMR	0.033
RMSEA	0.065
GFI	0.877
CFI	0.955
AGFI	0.839
NFI	0.905

Comparative Fit Index (CFI), cut-off >.90

Hypotheses Testing

In this stage the structural model was tested by utilizing a structural equation modelling (SEM) approach. Figure 8 summarizes the path coefficients of the model. Table 9 shows the results of the hypotheses tests by validating the presence of a statistically significant relationship in the predicted direction of the proposed research model. As expected, hypotheses H1, H2, H3 and H4 were supported in that perceived competence, perceived challenge, perceived choice and perceived interest all had a significant effect on behavioral intention. Overall, all 4 of the proposed hypotheses were supported by the data. Perceived competence (COM) had a significant effect on behavioral intention to use (BIU), with $p < 0.01$. Perceived challenge (CHA) had a significant influence on behavioral intention to use (BIU), with $p < 0.05$ and perceived choice (CHO) and perceived interest (INT) had a significant influence on behavioral intention to use (BIU), with $p < 0.001$.

Table 9. Hypotheses testing results

Hypothesis		*N=193*		Outcome
		Coefficient (SE)	**t-value**	
H1	COM → BIU	0.13 (0.04)	3.15**	Supported
H2	CHA → BIU	0.11 (0.04)	2.52*	Supported
H3	CHO → BIU	0.34 (0.04)	8.77***	Supported
H4	INT → BIU	0.47 (0.04)	7.32***	Supported

Note: *p* <*0.05 significance, ** *p* <0.01 significance, *** *p* <0.001 significance.

The structural model and hypotheses were tested by examining the path coefficients and their significance. Path coefficients are presented in Figure 8. Based on our hypotheses, COM showed a significant influence on BIU (path=0.13). Similarly, CHA showed a significant influence on BIU (path=0.11). CHO showed a significant influence on BIU (path=0. 34). The link between INT and BIU (path=0.47) was significant at the 0.001 level of variance.

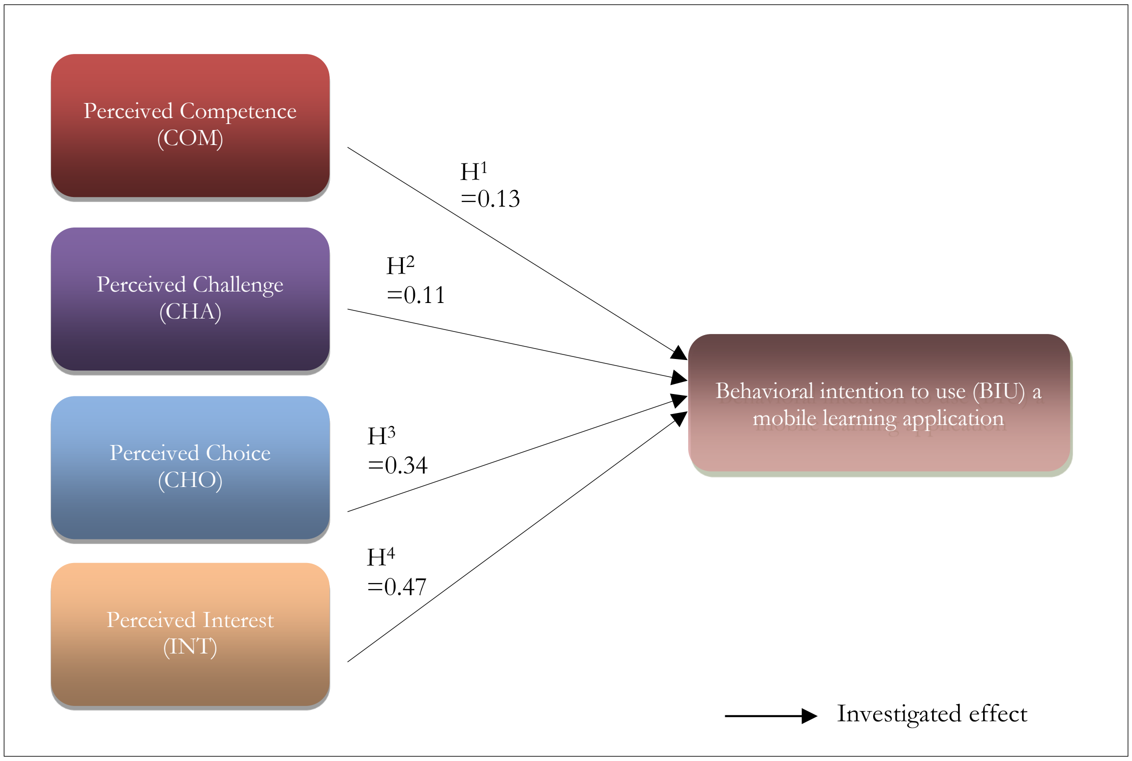

Figure 8. Path coefficient research model results

LIMITATIONS AND FURTHER RESEARCH

There are various limitations of this study that need to be examined. Firstly, the fact that students are individuals, with their own beliefs and values, may have a significant impact on their dispositions (Shroff, Deneen, & Ng, 2011). In this study, we relied on self-reported measures of the proposed constructs. Since the constructs were composed of individuals' perceptions of personal phenomena, self-report methods were necessary. Nonetheless, future work can reduce potential confounds via longitudinal designs, objective procedures, and use of behavioral measures (Shroff, Deneen, & Ng, 2011). Moreover, the results of this study should seen as preliminary evidence with respect to examining the causal relationship of intrinsic motivation factors on students' behavioral intention to use a mobile application. Finally, further research is required to clearly delineate the key factors supporting intrinsic motivation in the context of the effectiveness of mobile learning activities and instructional methods.

Future research is also necessary to examine the role of additional constructs. One environmental dimension, understudied but with likely implications for intrinsic motivation, is the social environment (Shroff & Vogel, 2009). Social information processing (Salancik & Pfeffer, 1978), may affect individual attitudes and behavior and has been shown along with objective task characteristics, to influence task perceptions and task behavior (Griffin, Bateman, Wayne, & Head, 1987). As such, these social interactions have the potential to enhance individual construction of knowledge by engaging the individual learner in activities that are interesting, challenging but not too difficult, arousing his or her perception of curiosity, permitting him or her to make decisions and allowing him or her to exercise control in terms of setting his or her own pace in mobile-supported learning activities

(Shroff, Vogel, & Coombes, 2008). Specific studies could also address various aspects of mobile learning, such as an individual's patterned ways of thinking, feeling, and reacting. The suggestions for future research, raised above, could likely build upon our results. Moreover, the results of this study can be used as base-line data for future research directions.

DISCUSSION

The purpose of this study was to test the causal relationship of perceived competence (COM), perceived challenge (CHA), perceived choice (CHO), and perceived interest (INT) on students' behavioral intention to use (BIU) a mobile application. The measurement model was confirmed with acceptable convergent and discriminant validity with respect to the measurement of all the constructs in the research model. The structural path model rendered a good fit to the data, indicating that perceived competence (COM), perceived challenge (CHA), perceived choice (CHO), and perceived interest (INT) had a significant influence on students' behavioral intention to use (BIU) a mobile application for learning. The statistical analyses we conducted found support for all of the hypotheses that this research has outlined. The theoretical framework and prior research discussed earlier in this paper provide the perspective for the following discussion.

With reference to the following assumption – *when students exercise skill or mastery using the app, they may have a favorable intention towards using the app* – in general, the results revealed that perceived competence (COM) had a significant effect on behavioral intention to use (BIU). An explanation might be that when students perceive the app as enhancing their capability (i.e., their proficiency and skillfulness) in learning, they may be more apt to continue using it in the future. Perceived competence represents the extent to which an individual believes that he or she has performed or is able to perform well at an activity (Baek & Touati, 2017; Froiland & Oros, 2014; Jeno, Grytnes, & Vandvik, 2017). This implies that individuals have an innate need to evaluate their own mastery and effectiveness and attain desired outcomes, when dealing with his or her environment. Perceived competence can be seen as an important function when interacting with an app, because it gives information about which tasks within the app are within the potential of an individual and which of these tasks are worth trying. This information may consist of the individual's previous achievements, characteristics of the tasks performed, information about his or her performances, and, finally, the reactions of that individual to his or her successes and failures and performance attempts in general (Shroff, Trent, & Ng, 2013).

With reference to the following assumption – *when students find engaging with the content challenging (i.e., testing their ability), they may have a favorable intention towards using the app* – the results revealed that perceived challenge (CHA) had a significant effect on behavioral intention to use (BIU). An explanation might be that when students experience success at challenging activities (i.e., trying to solve the crossword puzzle) their perception of being challenged increases, which in turn makes them more apt to continue using it in the future. Success may be the driving force – the amount of effort exerted on a challenging task is derived from the expectancy of success (Corno & Mandinach, 1983). A challenging task is represented by an individual's ability, conviction, and persistence to complete the given task (Hamari et al., 2016). Hence, an individual learns best when he or she engages in activities or tasks that challenge his or her current intellectual structure, but are not too difficult for him or her to master. Additionally, an individual's perception of the challenge of an activity should be equal to the perception of his or her skill levels and abilities.

With reference to the following assumption – *when students exercise choice as to how much they engage with the app or make selections within the app, they may have a favorable intention towards using the app* – the results revealed that perceived choice (CHO) had a significant effect on behavioral intention to use (BIU). An explanation might be that when students are provided with the flexibility and discretion (i.e., how much they wanted to engage with the app or make alternative selections of the different features within the app), they may be more apt to continue using it in the future. In the vocabulary crossword puzzle app, the player can opt for a multitude of methods to make progress in the game, by making discerning choices based on individual strengths and learning styles (Gee, 2003). Choice occurs when an individual perceives control of the selection process from among options of similar values and outcome certainties (Jellison & Harvey, 1973). Perlmuter and Monty (1971) claimed that individual perceived choice leads to improved performance, by increasing stimulation and sharpening cognitive engagement, in all aspects of the task. Clearly, different individuals have different preferences and certainly the more choices there are available, the more they will be able to find and select alternatives that best match their preferences (Shroff & Vogel, 2009).

With reference to the following assumption – *when students exhibit interest or the app holds their attention, they may have a favorable intention towards using the app* – the results revealed that perceived interest (INT) had a significant effect on behavioral intention to use (BIU). An explanation might be that when students have positive perception of their interest in engaging with the app (i.e., held their attention, aroused their curiosity, etc.) they may be more apt to continue using it in the future. For example, the user may be intrigued by the use of the interface, due to the fact that it is visually attractive, giving the perception of ease of use, and subsequently being able to solicit the users attention to engage with the app and subsequently continue to use it. Individual interest has a dispositional quality – an individual pursuing an interest may be motivated to do so across time, in different situations and when he or she requires special effort in performing tasks and activities (Shroff, Vogel, & Coombes, 2008). Individual interest emerges in part from resident interest within an individual and in part from features present in the environment. One way to promote greater involvement and therefore nurture individual interest, is to enrich instructional materials that arouse the senses (Berlyne, 1960). For example, we may be able to engage students by enhancing the user interfaces of the apps, with brighter colors, more attractive pictures (Cordova & Lepper, 1996; Parker & Lepper, 1992), and, also, by weaving games and puzzles into the apps. As a result, these features of the environment can affect the degree to which engaging with an app, is perceived to be interesting and fun (Agarwal & Karahanna, 2000).

CONCLUSION

This study is a careful first attempt towards an understanding of intrinsic motivation factors on university students' behavioral intention to use a mobile application for learning. By integrating a motivational perspective into the technology acceptance model, this study is one of the first attempts to empirically test the causal relationship of intrinsic motivational factors on students' behavioral intention to use (BIU) a mobile application. Hence, this study is a bold task in applying intrinsic motivation theory and TAM to the latest emerging context of use of a mobile application for learning.

We have presented a framework to examine the causal relationship of intrinsic motivation factors on students' behavioral intention to use a mobile application for learning. Undoubtedly, the theoretical framework and model may be open to further clarification and refinement, particularly with regard to other factors requiring examination for the support of individual student intrinsic motivation in mobile learning environments. Moreover, mediating factors such as an individual student's prior experiences, beliefs and personal biographies, need to be taken into consideration for this study. Nonetheless, this study offers some interesting insight and contributions relative to understanding student intrinsic motivation and technology acceptance in mobile-supported learning environments. In view of the limited studies on intrinsic motivation in mobile learning environments, the framework explicated in this study, may present opportunities for future constructive discourse.

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APPENDIX

MOBILE APPLICATION MOTIVATION INVENTORY (MAMI)

SECTION I
BACKGROUND INFORMATION
Please [√] only one answer for the following questions.

1	Have you used a mobile app before? ☐ Yes ☐ No
2	How often do you use mobile applications (daily, weekly, monthly, yearly, never)? ☐ Daily ☐ Weekly ☐ Monthly ☐ Yearly ☐ Never
3	Have you used a mobile app in a course before taking this class?: ☐ Never ☐ Once ☐ Two to three times ☐ More than three times. ☐ Other (please specify)……………….
4	During this course, how often did you review and interact with the app for this course? ☐ Not at all ☐ About once each month ☐ A few times a month ☐ About once each week ☐ A few times a week ☐ Five to six times a week ☐ About once a day ☐ Several times a day ☐ Other (please specify)……………………………………………………………………
5	Please rate the extent to which you are comfortable with using this app for this course: ☐ Don't know or never used ☐ Extremely uncomfortable ☐ Somewhat comfortable ☐ Somewhat comfortable ☐ Fairly comfortable ☐ Extremely comfortable
6	After using the app in this course, how would you rate your ability? ☐ Low ☐ Moderate ☐ High
7	With regard to technology in general, how would you describe your skill level? ☐ Beginner ☐ Intermediate ☐ Advanced
8	Gender: ☐ Female ☐ Male
9	Your year in school: ☐ 1 ☐ 2 ☐ 3 ☐ 4

SECTION II:
PERCEIVED COMPETENCE

Please rate the extent to which you agree with each statement below.
(Please circle the most appropriate option for each statement below)

	7= Strongly Agree 6= Moderately Agree 5= Slightly Agree 4= Neither Agree nor Disagree 3= Slightly Disagree 2= Moderately Disagree 1= Strongly Disagree							
10	Using the app for this course enhanced my capability in learning.	7	6	5	4	3	2	1
11	I felt I had sufficient skill to be able to interact with the app for this course.	7	6	5	4	3	2	1
12	I felt I was proficient in using the app for this course.	7	6	5	4	3	2	1
13	I felt I was competent in my performance in using the app for this course.	7	6	5	4	3	2	1

PERCEIVED CHALLENGE

Please rate the extent to which you agree with each statement below.
(Please circle the most appropriate option for each statement below)

	7= Strongly Agree 6= Moderately Agree 5= Slightly Agree 4= Neutral 3= Slightly Disagree 2= Moderately Disagree 1 = Strongly Disagree							
14	Using the app for this course allowed me to set challenging goals for myself to achieve.	7	6	5	4	3	2	1
15	I was able to exert the effort to be successful in using the app for this course.	7	6	5	4	3	2	1
16	I felt my engagement with the app for this course reflected the right balance of difficulty.	7	6	5	4	3	2	1
17	I felt the app for this course allowed me to generate my own performance goals of variable difficulty.	7	6	5	4	3	2	1

PERCEIVED CHOICE

Please rate the extent to which you agree with each statement below.

(Please circle the most appropriate option for each statement below)

	7= Strongly Agree 6= Moderately Agree 5= Slightly Agree 4= Neutral 3= Slightly Disagree 2= Moderately Disagree 1 = Strongly Disagree							
18	I felt like it was up to my own choice as to how much I engaged in the app for this course.	7	6	5	4	3	2	1
19	Using the app for this course enabled me to make alternative selections of the different features within the app.	7	6	5	4	3	2	1
20	I felt that I could decide as to how I navigated through the app for this course.	7	6	5	4	3	2	1
21	I felt I had discretion as to how I explored details of specific content when using the app for this course.	7	6	5	4	3	2	1

PERCEIVED INTEREST

Please rate the extent to which you agree with each statement below.

(Please circle the most appropriate option for each statement below)

	7= Strongly Agree 6= Moderately Agree 5= Slightly Agree 4= Neither Agree nor Disagree 3= Slightly Disagree 2= Moderately Disagree 1 = Strongly Disagree							
22	I felt excited about what I was learning using the app for this course.	7	6	5	4	3	2	1
23	I felt the main features of the app stimulated my interest.	7	6	5	4	3	2	1
24	Using the app for this course held my attention.	7	6	5	4	3	2	1
25	Using the app for this course aroused my curiosity to click through and engage with the app.	7	6	5	4	3	2	1

INTENTION TO USE THE MOBILE APPLICATION
Please rate the extent to which you agree with each statement below.
(Please circle the most appropriate option for each statement below)

	7= Strongly Agree 6= Moderately Agree 5= Slightly Agree 4= Neither Agree nor Disagree 3= Slightly Disagree 2= Moderately Disagree 1 = Strongly Disagree							
26	I intend to use the app frequently for my coursework.	7	6	5	4	3	2	1
27	I intend to continue using the app more in my learning activities.	7	6	5	4	3	2	1
28	Whenever possible, I intend to use the app as often as needed.	7	6	5	4	3	2	1
29	I expect my use of the app to continue in the future.	7	6	5	4	3	2	1

BIOGRAPHIES

Dr. Ronnie H. Shroff is the Assistant Director of the Resource Centre for Ubiquitous Learning & Integrated Pedagogy (ULIP) at Hong Kong Baptist University. Ronnie holds a Ph.D. in Information Systems from The City University of Hong Kong. His professional interests include the use of mobile technologies to support teaching and learning environments.

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