Innoeduca. International Journal of Technology and Educational Innovation
Vol. 10. No. 2. December 2024 - pp. 93-112 - ISSN: 2444-2925 DOI: https://doi.org/10.24310/ijtei.102.2024.18122

Teachers' acceptance of technology-based simulation games as teaching pedagogy in management education: an extended technology acceptance model

Aceptación de los docentes de los juegos de simulación basados en tecnología como pedagogía docente en la educación gerencial: un modelo extendido de aceptación de la tecnología

RECEIVED 18/12/2023 ACCEPTED 12/03/2024 PUBLISHED 01/12/2024

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ABSTRACT

The present study investigates the factors underlying the adoption of technology-based simulation games (SGs) by teachers in the formal management education. The proposed framework is an integration of the widely used Technology Acceptance Model (TAM); two institutional factors namely, top management support and training; and one individual factor, i.e. self-efficacy. The proposed model was empirically tested using a sample of 311 teachers selected using convenience sampling from the Indian management institutions. The primary data was gathered through surveys of teachers from business and management schools in India. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to test the proposed model. This study has found that the three external variables, i.e. top management support, training opportunities and self-efficacy, have direct influence on the two constructs of TAM (i.e. perceived usefulness and perceived ease of use), and have indirect influence on adoption intention of simulation games. The findings of this study have relevance to the SG developers as well as the top authorities / management of business schools. The findings suggest that SG developers must concentrate on creating the solutions that fit well with the teachers' current pedagogies. Moreover, the management of business schools provide adequate training and support to their teachers to promote the adoption of SGs. The study contributes to the literature by putting forward the perceptions of management teachers within Indian contexts. By proposing an extended TAM model, the study has contributed to the knowledge of educational technology adoption in the context of technology-based simulations for teaching.

KEYWORDS Technology; simulation games; TAM; management education; teaching pedagogy.

RESUMEN

El presente estudio investiga los factores que subyacen a la adopción de juegos de simulación (SG) basados en tecnología por parte de profesores en la educación formal en gestión. El marco propuesto es una integración ampliada del Modelo de Aceptación de Tecnología (TAM); dos factores institucionales, a saber, el apoyo y la formación de la alta dirección; y un factor individual, es decir, la autoeficacia. El modelo propuesto se probó empíricamente utilizando una muestra de 311 docentes seleccionados mediante muestreo por conveniencia de las instituciones de gestión de la India. Los datos primarios se recopilaron a través de encuestas a profesores de escuelas de negocios y administración de la India. Se utilizó el modelo de ecuaciones estructurales de mínimos cuadrados parciales (PLS-SEM) para probar el modelo propuesto. Este estudio ha encontrado que las tres variables externas, es decir, el apoyo de la alta dirección, las oportunidades de capacitación y la autoeficacia, tienen influencia directa en los dos constructos de TAM (es decir, utilidad percibida y facilidad de uso percibida), y tienen influencia indirecta en la intención de adopción de juegos de simulacion. Los hallazgos de este estudio son relevantes para los desarrolladores de SG, así como para las principales autoridades y direcciones de las escuelas de negocios. Los hallazgos sugieren que los desarrolladores de SG deben concentrarse en crear soluciones que se ajusten bien a las pedagogías actuales de los docentes. Además, la dirección de las escuelas de negocios proporciona formación y apoyo adecuados a sus profesores para promover la adopción de SG. El estudio contribuye a la literatura al presentar las percepciones de los profesores de gestión en contextos indios. Al proponer un modelo TAM extendido, el estudio ha contribuido al conocimiento de la adopción de tecnología educativa en el contexto de simulaciones basadas en tecnología para la enseñanza.

PALABRAS CLAVE Tecnología; juegos de simulación; TAM; educación gerencial; pedagogía de la enseñanza.

1. INTRODUCTION

The higher education programs in management have often been criticized for their pedagogical issues such as, disconnect of curriculum from management practice, teacher-directed learning with limited student engagement and knowledge sharing, and limited attention to developing affective, moral, critical thinking and problem-solving skills in students (Sierra, 2020). These issues can be addressed through incorporating student-centric experiential learning models in instructional methods. “Games and simulations” are amongst those active learning methodologies that can be aligned with several goals of management education (Al-Azawi et al., 2016; Dichev and Dicheva, 2017; López et al., 2021; Roungas et al., 2021). Educational games and simulations can engage students in solving complex and dynamic management problems through applying job-relevant knowledge and skills (Lu et al., 2014; Sierra, 2020) and gaming elements positively affect their motivation and attitude (Galiç & Yıldız, 2023).

Recent technological advances have led to the development of computer-based simulation games (SGs) that make use of innovative technologies such as artificial intelligence, virtual reality, and augmented reality. SGs based on such technologies have increased levels of authenticity, flexibility, immediacy, realism, and engagement (Krath et al., 2021; McGarr, 2020). These SGs provide an artificial reproduction of a reality where learners use their knowledge and skills to solve a problem in the virtual world (Pasin & Giroux, 2011). SG based learning can not only address the cognitive and affective learning issues but can also facilitate interactivity and collaboration (Jean Justice & Ritzhaupt, 2015; Lu et al., 2014). Because of the numerous benefits of SGs, management and business schools have been looking for such solutions to create a new

learning environment that better corresponds with the habits and interests of their students (Koutska, 2023). However, previous research has found that adoption of SGs in formal educational programs has been slow, as it requires expensive resources, advanced facilities, and trained teachers / faculty members (Kim & Watson 2017). The adoption of such educational technologies is especially challenging in Asian countries, which lack educational technology infrastructure and human capacity to implement modern educational strategies (Dede, 2018). Though studies in the past have tried to identify the barriers in the acceptance of SGs (Siala et al., 2020; Watson & Yang, 2016), however there is a dearth of empirical studies taking a broad enough approach to identify the influencing factors of adopting technology-based SGs in management education within the context of Asian countries (Jean Justice & Ritzhaupt, 2015). Moreover, even though teachers are primary agents in introducing innovative educational methods, previous research has neglected the role of teachers in integrating SGs with education (Jong & Shang, 2015).

Hence, the present study proposes a model of factors that influence the adoption of technology-based SGs by management teachers in India. The proposed framework is an integration of the widely used Technology Acceptance Model (TAM; Davis, 1989); two institutional factors namely, top management support and training; and one individual factor, i.e. self-efficacy. The study makes two worthwhile contributions to the literature. First, it addresses the barriers to the adoption of SGs in Indian management institutions, which is an under researched area. Second, by integrating the TAM with individual and institutional characteristics, the study addresses the calls by previous researches to extend TAM in educational contexts (Mailizar et al., 2021).

The paper is organized as follows: The theoretical background of the study is discussed in section 2 and, the conceptual framework of the study along with hypotheses development are discussed in section 3. The research design and data collection procedure are discussed in section 4. Section 5 presents the data analysis and results. Further, results have been discussed in section 6 followed by conclusion and limitations of the study in section 7.

1.1. Theoretical background

1.1.1. Conceptualizing SGs

Simulation is an educational tool that reproduces the real-life situations of an event. Educational simulations can be broadly classified into two categories: non-computer-based and computer-based (López, et al., 2021). Non-computer-based simulations involve manual exercises, games and physical interactions among the students that are constrained by a fixed set of rules and procedures. On the other hand, computer-based simulations make use of computers and technology to replicate system characteristics (Hinck & Ahmed, 2015). For example, training simulations (such as flight simulators) are used to imitate real-world processes to improve performance of the user in accomplishing a certain task, whereas modeling simulations (such as weather simulations or car modeling) are used to model processes or objects to test and/or create a model (De Smale et al., 2016). Simulation games are goal-oriented imitation of real-world processes that may be played against a computer model (single-user application), or against other users through a computer application (multi-user application) (Hinck & Ahmed, 2015). They allow learners to learn in a more enjoyable and interactive way by using technology-based resources in a scenario-based environment (López, et al., 2021).

SGs in management education

The SGs used in management education create a dynamic team learning environment integrating three components: (1) a computer-coded business simulator; (2) a team of students (participants) who compete through interaction and decision-making; and (3) an administrator (teacher) who directs and observes the students' behavior (Hinck & Ahmed, 2015). The students in a SG play in a virtual environment, wherein they employ budgeted resources (such as money, time, personnel) to achieve specific goals related to sales, productivity, or market share (Lu et al., 2014). Research into SGs suggest that they provide a valid representation of real-world issues to the learners, integrating a wide range of management concepts and tools (Hinck & Ahmed, 2015). The students can acquire necessary management skills through SGs, such as strategy formulation, problem solving, communication skills, team work, and analysis of multiple variables (López, et al., 2021). Most authors agree that SGs help in improving learning outcomes (Ahmed & Sutton, 2017).

1.1.2. Teachers' perceptions on adopting SGs

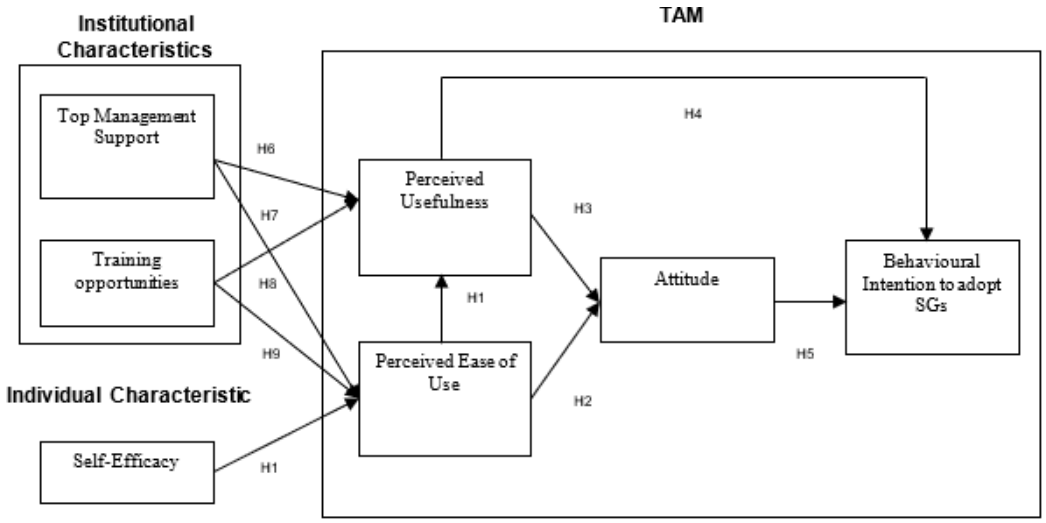
Jean Justice and Ritzhaupt (2015) developed an instrument to measure teacher perceived barriers to adopting SGs in education. They categorized the barriers into seven categories namely, negative student outcomes; technology issues; SG specific issues; issues related to teachers; incorporation issues; limited student abilities; and issues related to justifying the use of SGs in education. Vos and Brennan (2010) have studied the perceptions of marketing management teachers regarding the barriers to using SGs. The authors conclude that financial cost, administrative work-load concerns, and necessary skills for using SGs, are the major barriers to adopting SGs. The teachers face difficulties in obtaining permissions form institutional authorities to make investment in expensive SGs (Vos & Brennan, 2010). They also require time to learn a SG prior to using it as a pedagogical tool in classrooms (Vos and Brennan, 2010). Administrative support in terms of time and training have been cited by several researchers as a barrier to the adoption of SGs in education (Watson & Yang, 2016). According to Dimitriadou et al. (2021), lack of time, lack of resources and lack of administrative support are major obstacles to the adoption of SGs in education.

To sum up, most of the existing studies have emphasized on the barriers to adopt SGs in education. There is a dearth of empirical studies that can identify the factors that determine teachers' adoption of SGs. The present study attempts to fill this gap by taking a broad approach to identify the predictors of teachers' intention to adopt SGs in management education. We propose a framework based on widely used TAM (Davis, 1989). Because of its straightforwardness and good explanatory power, TAM has been a dominant model for investigating users' technology acceptance behavior in different organizational contexts (Rahman et al., 2017). TAM has been largely used in the education sector to understand the teacher's intention to adopt new educational technologies (Pando-Garcia et al. 2016; Sharma & Srivastava; 2019; Saroia & Gao, 2019; Wu & Chen, 2017). Nevertheless, researchers have found certain limitations in TAM because of its restricted constructs. TAM has been critiqued for its inability to include the determinants of its two major constructs i.e. perceived usefulness and perceived ease of use variables (Malatji et al., 2020). It is therefore advised to extend TAM with other external factors depending on the context of the study (Ajibade, 2018). Hence, we propose an integrated model that extends TAM with two institutional characteristics (namely, top management support and training opportunities), and one individual characteristic (namely, self-efficacy), to study the management teachers' intention to adopt SGs.

1.2. Conceptual framework

The proposed framework is depicted in Fig. 1. Based on the proposed research model, nine hypotheses have been developed as discussed below.

FIGURE 1. Proposed framework



1.2.1. Hypotheses related to TAM variables

The TAM (Davis, 1989) includes four constructs namely, behavioural intention (BI) to adopt a technology, attitude (ATT) towards technology usage, perceived usefulness (PU) and perceived ease of use (PEoU). In this study, BI is defined as the degree to which teachers are inclined to adopt SGs in management education. ATT is defined as the degree that measures teachers' interests in using SGs. PU is defined as the degree to which teachers believe that using SGs will enhance their teaching performance. PEoU refers to the degree to which teachers expect that using SGs is free of effort.

The following relationships between the TAM constructs have been included in the original TAM (Davis, 1989): PU is positively influenced by PEOU; ATT is positively influenced by both PU and PEOU; and BI is positively influenced by ATT as well as PU. These relationships have been tested in previous studies for explaining the adoption of technologies in different educational contexts, such as virtual reality (Sagnier et al., 2020) Cloud based virtual reality (Sayginer, 2023), mobile learning management systems (Saroia & Gao, 2019), virtual reality simulation (Fagan et al., 2012), and Massive Open Online Courses (Wu & Chen, 2017). Rafique et al. (2023) found that PEoU is a very strong determinant of teachers' intention to use e-learning technology. Pando-Prior studies have confirmed that confirmed that PEoU and PU strongly determine the attitude to use business simulation games (Pando-Garcia et al., 2016) and micro-games (Wijaya et al., 2022a), which in turn determines the intention to use the same. Thus, we propose the following hypotheses.

H1: PEoU has a significant positive influence on PU of SGs

H2: PEoU has a significant positive influence on ATT towards using SGs

H3: PU has a significant positive influence on ATT towards using SGs

H4: PU has a significant positive influence on BI to adopt SGs

H5: ATT has a significant positive influence on BI to adopt SGs

1.2.2. Hypotheses related to external variables

Top management support

According to Hsu et al. (2019), top management support (TMS) refers to the beliefs of top authorities regarding the usefulness of a technology or innovation, in creating value for their organization. It ensures a long-term vision, commitment of resources required for using the innovation, as well as an organization climate that is supportive of using the innovation (Gupta & Bhaskar, 2023). Within the educational contexts, Saroia and Gao (2019) argued for positive influence of TMS on PU and PEoU of mobile learning management systems. Iqbal and Bhatti (2017) also highlighted the importance of TMS for innovative learning initiatives. The authors also concluded that TMS has significant positive impacts on students' perceptions of PEOU and PU of innovative educational technologies. Thus, the present study hypothesizes that TMS (in terms of availability of resources, time and technical assistance) will positively influence the teachers' perceptions regarding PEoU and PU of SGs. Hence, the following hypotheses are proposed:

H6: TMS has a significant positive influence on PU of SGs

H7: TMS has a significant positive influence on PEoU of SGs

Training opportunities

Training refers to the degree to which an organization trains its employees for using a tool/ technology/ innovation. Training is helpful in reducing employees' stress and ambiguity about the use of a technology (Gangwar et al., 2015). Since teachers may find difficulties in incorporating SGs in their teaching pedagogy, the institutions should provide opportunities to train and educate them regarding the usage of SGs (Sánchez-Mena & Martí-Parreño, 2017). Training provides a better understanding about the benefits of SGs and reduces teachers' anxiety about the use of SGs (Vlachopoulos & Makri, 2017). Gangwar and Date (2015) confirmed that training positively influences the PEoU and PU of a technology. For the present study, we hypothesize that training opportunities (TO) will help teachers develop knowledge about SGs as well as make effective use of SGs. Thus, the following hypotheses are postulated:

H8: TO has a significant positive influence on PU of SGs

H9: TO has a significant positive influence on PEoU of SGs

Self-efficacy

Self-efficacy (SE) is a measurement of an individual's capability to perform a task (Zhi et al., 2023). For the present study, self-efficacy is considered to include a teacher's general skills and capabilities that are required to accomplish the tasks related to SGs. Recent research indicates that computer self-efficacy significantly determines PEoU of a technology (Ali & Warraich, 2023). Within the educational contexts, self-efficacy has been found to indirectly affect teachers' intentions via PEoU (Joo et al., 2018). Eraslan Yalcin and Kutlu

(2019) found a significant impact of computer self-efficacy on PEoU. Sharma and Saini (2022) found that teachers with high self-efficacy feel less anxious about using educational technologies in classrooms. Also, Guillén-Gámez et.al., (2021) noted that age and gender also affect the digital competence of the educae tors. Since, teachers require basic technical and quantitative skills for using SGs, hence we hypothesize that teachers with high SE will find SGs easy to use. Thus, we propose the following hypothesis:

H10: SE has a significant positive influence on PEoU of SGs

2. MATERIAL AND METHOD

2.1. Design and Sample

The present study employed an analytical cross-sectional research design, wherein the primary data was collected through a survey that was carried out during January-February 2023. The cross-sectional research designs are useful for exploring the relationships between various variables (Kesmodel, 2018). Teachers from business schools or management/business studies departments of universities in India, who have used SGs at least once in their classes, were the target respondents of the study. As per the National Institutional Ranking Framework (NIRF) of India, there are 75 business/management schools/institutions in various states of India (National Institutional Ranking Framework, 2021). These 75 institutions served as the target population for the current study. A non-random sampling technique i.e. convenience sampling was used to select the target respondents from these 75 institutions. A total of 500 teachers were contacted using convenience sampling to fill in the paper-based/online questionnaires, out of which 341 questionnaires were returned. After removing the unviable responses, a total of 311 usable questionnaires were. Table 1 illustrates the respondents' characteristics for both the samples as well as the combined sample.

TABLE 1. Sample Profile

RESPONDENT'S CHARACTERISTIC	CATEGORIES	Combined Sample (n=311)	
		n	%
Gender	Male	154	49.5%
	Female	157	50.5%
Teaching experience	<= 10 years	140	45.0%
	11 years - 20 years	98	31.5%
	>= 20 years	73	23.5%
Academic department	Finance and Accounting	72	23.2%
	Marketing Management	95	30.5%
	Human Resource Management	39	12.5%
	Operations Management	15	4.8%
	Analytics	14	4.5%
	General Management	76	24.4%
Type of Institution	Government	121	38.9%
	Private	190	61.1%

2.2. Survey instrument

A structured questionnaire was used as the survey instrument. The questionnaire consisted of two parts. The first part included questions on respondents' demographic characteristics such as gender, years of teaching experience, academic department, and type of institution. The second part included 22 items to measure the seven research constructs used in this study. To ensure construct validity, the items used in the questionnaire were adapted from previous studies (Cheon et al., 2012; Pando-Garcia et al., 2016; Rajan & Baral, 2015; Sagnier et al., 2020). To fit the context of SGs, some minor word changes were made in the scale items. The questionnaire was pre-tested with 10 academics to ensure the face validity of items. The questions in the first part of the questionnaire were categorical (nominal), whereas the items in the second part were measured using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

2.3. Data analysis technique

We used the partial least squares structural equation modelling (PLS-SEM) to test the proposed model. PLS-SEM is a non-parametric technique, which is robust in the cases concerning distribution issues such as lack of normality (Hair et al., 2019). Moreover, it can also be used with small samples (Hair et al., 2019; Staples & Seddon, 2004). Hence, PLS-SEM is an appropriate technique for the present study. As recommended by Cohen (1992) and Hair et al. (2019), the sample size to perform PLS-SEM depends on the number of causal paths pointing towards an endogenous construct in the structural model. In this study, the maximum number of such paths is 3 (see Fig. 1), which requires a sample size of 59 to ensure a statistical power of 80% (Cohen, 1992; Hair et al., 2019). Our study sample met this criterion with a sample size of 311. The SmartPLS 4 software was used to perform PLS-SEM. The PLS-SEM was applied using a two-step approach that included the evaluation of measurement model followed by the estimation of structural model (Sarstedt & Cheah, 2019). The reliability and validity of the model constructs were established by evaluating the measurement model, and hypothesized relationships between the constructs were tested using the structural model (Guillén-Gámez et al., 2024; Liu et al., 2022; Wijaya et al., 2022b).

3. RESULTS

3.1. Descriptive statistics

Table 2 indicates the mean, standard deviation, skewness and kurtosis values of all the items. As can be observed from the table, the mean score for all the items was greater than 3 which indicates that the respondents provided positive responses for all the items. Further, the skewness and kurtosis values of all the items were within the threshold limits of 3 and 10 respectively (Moorthy et al., 2019), indicating univariate normality.

TABLE 2. Descriptive Statistics

CONSTRUCT	ITEM	MEAN	STANDARD DEVIATION	SKEWNESS	KURTOSIS
TMS	TMS1	3.66	0.959	-0.479	0.027
	TMS2	3.67	0.909	-0.332	-0.132
	TMS3	3.64	0.929	-0.440	0.195
TO	TO1	3.58	0.993	-0.530	0.111
	TO2	3.65	0.987	-0.442	-0.166
	TO3	3.57	0.996	-0.363	-0.323
SE	SE1	3.62	0.962	-0.418	-0.218
	SE2	3.67	0.992	-0.312	-0.419
	SE3	3.65	0.949	-0.289	-0.209
PEoU	PEoU1	3.86	0.948	-0.554	-0.203
	PEoU2	3.83	1.003	-0.630	-0.075
	PEoU3	3.86	0.969	-0.651	-0.161
PU	PU1	3.92	0.905	-0.815	0.682
	PU2	3.86	0.906	-0.507	-0.051
	PU3	3.92	0.888	-0.830	0.843
	PU4	3.93	0.915	-0.683	0.262
ATT	ATT1	3.90	0.968	-0.887	0.626
	ATT2	3.79	0.991	-0.709	0.072
	ATT3	3.78	0.987	-0.630	0.008
BI	BI1	3.79	0.913	-0.702	0.586
	BI2	3.73	0.938	-0.569	0.211
	BI3	3.76	0.968	-0.555	0.099

3.3. Measurement model

The reflective measurement model was examined to establish the reliability and validity of the latent constructs. Table 3 depicts the analysis of the measurement model for the combined sample. The item reliability was evaluated by examining the indicator loadings. Since all the indicator loadings (see Table 3) were greater than the recommended value of 0.708 (Hair et al., 2019), hence the item reliability was ensured. To assess the construct reliability, we examined the internal consistency reliability on the basis of composite reliability (CR) and Cronbach's alpha. The values of CR and Cronbach's alpha (see Table 2) for all the latent constructs fall in the acceptable range of 0.70 – 0.90, indicating that the constructs were reliable. Some researchers argue that βA is a more appropriate measure of construct reliability as compared to CR and Cronbach's alpha (Dijkstra & Henseler, 2015). An examination of the values of ρA (see Table 3) also confirmed the reliability of the constructs as the values lied between the lower bounds of Cronbach's alpha and upper bounds of CR (Hair et al., 2019). The convergent validity was assessed through the metric average variance extracted (AVE). The AVE value of each construct was higher than the recommend value of 0.50 (Hair et al., 2019), indicating that each construct explained more than 50 per cent of the variance of its corresponding items.

TABLE 3. Reliability and Validity

CONSTRUCT	ITEM	LOADING	T-STATISTIC	CRONBACH'S ALPHA	PA	CR	AVE
TMS	TMS1	0.89	56.82***	0.853	0.853	0.911	0.773
	TMS2	0.86	36.48***				
	TMS3	0.88	45.60***				
TO	TO1	0.85	38.77***	0.835	0.835	0.901	0.753
	TO2	0.86	34.40***				
	TO3	0.89	48.57***				
SE	SE1	0.88	53.68***	0.812	0.821	0.889	0.727
	SE2	0.82	27.50***				
	SE3	0.86	40.47***				
PEoU	PEoU1	0.89	72.17***	0.810	0.816	0.888	0.725
	PEoU2	0.87	46.45***				
	PEoU3	0.79	23.75***				
PU	PU1	0.83	33.17***	0.868	0.868	0.91	0.716
	PU2	0.85	36.28***				
	PU3	0.86	44.77***				
	PU4	0.84	43.84***				
ATT	ATT1	0.88	55.32***	0.833	0.834	0.9	0.75
	ATT2	0.85	38.25***				
	ATT3	0.87	40.39***				
BI	BI1	0.85	35.90***	0.805	0.805	0.885	0.719
	BI2	0.83	32.89***				
	BI3	0.86	47.85***				

To ensure that each construct was empirically distinct from the other constructs in the model, we assessed the discriminant validity. Following the criteria of Fornell and Larcker (1981), we compared each construct's AVE to its squared inter-construct correlations with all other constructs in the model. Table 4 illustrates the inter-construct correlations (off-diagonal elements) and the squared roots of AVEs (diagonal elements). The shared variance (inter-construct correlations) for all constructs were found to be lesser than the squared roots of their AVEs (see Table 4). Hence discriminant validity was ensured. We also examined the heterotrait-monotrait (HTMT) ratio of the correlations (Voorhees et al., 2016) to further ensure the discriminant validity. As the HMTT values (see Table 4) were lower than the suggested threshold of 0.90 (Henseler et al., 2016), discriminant validity problems were not present.

TABLE 4. Discriminant Validity

FORNELL AND LARCKER (1981) CRITERION							
	ATT	BI	PEoU	PU	SE	TMS	TO
ATT	0.866						
BI	0.749	0.848					
PEoU	0.682	0.707	0.852				
PU	0.716	0.782	0.733	0.846			
SE	0.474	0.636	0.543	0.552	0.853		
TMS	0.487	0.571	0.498	0.524	0.541	0.879	
TO	0.552	0.662	0.562	0.62	0.554	0.529	0.867
HTMT RATIOS							
	ATT	BI	PEOU	PU	SE	TMS	TO
ATT							
BI	0.815						
PEOU	0.828	0.842					
PU	0.840	0.834	0.832				
SE	0.574	0.785	0.666	0.654			
TMS	0.577	0.687	0.600	0.608	0.650		
TO	0.660	0.807	0.682	0.726	0.670	0.626	

3.4. Structural Model

Following the recommendations of Henseler et al. (2016), we assessed the structural model through five steps including - multicollinearity analysis; path analysis; coefficient of determination (R2); effect sizes(f2); and predictive power. Each of these steps are discussed below.

1. Collinearity: The collinearity was examined through variance inflation factor (VIF) values, to ensure the unbiasedness of the regression results (Kock, 2015). The VIF values (see Table 4) of the predictor constructs were lower than 3, indicating the absence of collinearity issues (Hair et al., 2019).
2. Path analysis: The significance levels for the paths in the structural model were estimated through bootstrapping with 2000 resamples. Table 5 provides the path coefficients (β) for the samples. The path coefficients for the overall sample provide support for all the hypotheses. Specifically, the analysis can be summarized as follows: PEoU has a statistically significant positive influence on PU (β=0.526, p<0.001) thus confirming hypothesis H1. Both PEoU (β=0.341, p<0.01) and PU (β=0.465, p<0.001) carry significant influence on ATT thus supporting hypotheses H2 and H3. The results also show that PU is more important construct than PEoU in explaining ATT. The results further indicate that PU (β=0.504, p<0.001) and (β=0.389, p<0.001) ATT significantly influence BI, with PU having stronger influence. Hence H4 and H5 are also supported. With regards to the institutional characteristics, TMS is found to have significant positive influence on both PU (β0.127, p<0.05) and PEoU (β=0.185, p<0.05). Similarly, TO is found to have significant positive influence on both PU (β=0.257, p<0.001) and PEoU (β=0.317, p<0.001). Hence the hypotheses H6 – H9 are supported. The results also indicate that both TMS and

TO are able to explain PEoU more than PU. Finally, the influence of the individual characteristic i.e. SE on PEoU (β=0.267, p<0.001) is also found to be significant.

We also examined the significance of indirect paths in the model. Table 5 illustrates the indirect path coefficients along with their significance. The results provide support for the significance of all the indirect paths. Specifically, PEoU (β=0.494, p<0.001) is found to be the strongest indirect influencer of BI, that is followed by TO (β=0.331, p<0.001), TMS (β=0.179, p<0.001) and SE (β=0.133, p<0.001). This indicates that BI is not only directly determined by ATT and PU, but also influenced indirectly by TO, TMS and SE. TO (β=0.304, p<0.001) is found to be the strongest indirect influencer of ATT, that is followed by TMS (β=0.169, p<0.001) and SE (β=0.156, p<0.001). SE (β=0.142, p<0.001) is found to be the strongest indirect influencer of PU, that is followed by TO (β=0.164, p<0.001) and TMS (β=0.098, p<0.01). The significant results of the indirect effects indicate that the institutional characteristics (i.e., TMS and TO) and individual characteristic (i.e. SE) are indirect determinants of ATT as well as BI. This provides support for the extension of TAM with the individual and institutional characteristics.

TABLE 5. Path Coefficients

HYPOTHESIS	PATH	β	t-statistic	VIF	RESULT	f2
H1	PEoU → PU	0.526	10.705***	1.592	Supported	1.39
H2	PEoU → ATT	0.341	3.468**	2.164	Supported	0.39
H3	PU → ATT	0.465	6.233***	2.164	Supported	1.56
H4	PU → BI	0.504	6.878***	2.049	Supported	1.27
H5	ATTU → BI	0.389	5.148***	2.049	Supported	0.16
H6	TMSU → PU	0.127	2.531*	1.511	Supported	0.10
H7	TMSU → PEoU	0.185	3.131*	1.584	Supported	0.03
H8	TOU → PU	0.257	5.102***	1.662	Supported	0.02
H9	TOU → PEoU	0.317	4.617***	1.615	Supported	0.01
H10	SEU → PEoU	0.267	4.22***	1.646	Supported	0.10

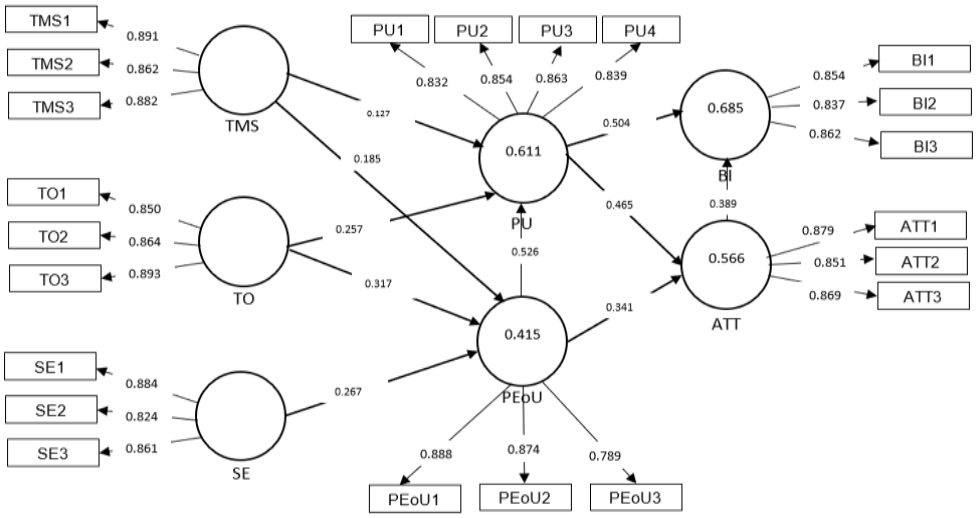
Note: *p<0.05; **p<0.01; ***p<0.001

TABLE 6. Indirect effects

PATH	β	t-statistic
PEoU → BI	0.494	11.201***
SE → ATT	0.156	4.028***
SE → BI	0.133	3.879***
SE → PU	0.142	3.605***
TMS → ATT	0.169	3.600***
TMS → BI	0.179	3.651***
TO → ATT	0.304	5.688***
TO → BI	0.331	6.028***

3. Coefficient of determination (R2): This coefficient indicates the variance explained by the predictor variables (exogeneous variables) in an endogenous variable. R2 values at the threshold of 0.25, 0.50 and 0.75 indicate weak, moderate, and substantial levels (Hair et al., 2019). Our model (see Fig. 2) explained moderate to substantial variance in the endogenous constructs: PEoU (R2=41.5%), PU (R2=61.1%), ATT (R2=56.6%) and BI (R2=68.5%).
4. Effect size (f2): To assess the strength of the hypothesized relationships, the effect sizes (f2) were calculated. According to Cohen (2013), f2 ≥ 0.02, f2 ≥ 0.15, and f2 ≥ 0.35 represent small, medium, and large effect sizes. Table 4 indicates the effect sizes for each relationship.
5. Predictive power: The model's predictive accuracy was also assessed by Stone-Geisser criterion Q2 criteria (Geisser, 1975). According to Hair et al. (2019), Q2 values above zero indicate that the model has predictive relevance. According to Guillén-Gámez et al. (2024), the Q2 values of 0.02, 0.15, and 0.35 are indicative of small, medium and large predictive powers. Our results revealed that the predictive relevance was medium to large for all the endogenous constructs: PEoU (Q2=28.8%), PU (Q2=42.7%), AT (Q2=41.3%) and BI (Q2=48.2%).

FIGURE 2. Structural model with R^2 values



4. DISCUSSION

This research analyzed teachers' intention to adopt technology-based simulation games in management education, based on the data collected from India. The study proposed a modified model of factors by extending the TAM with two institutional factors (i.e. top management support and training) and one individual factor (i.e. self-efficacy). Our study has found support for all the proposed hypotheses.

4.1. Perceived usefulness and attitude positively influence teachers' intention to adopt simulation games

Specifically, the findings of our study argue for strong roles of perceived usefulness and attitude in determining teachers' intention to adopt simulation games. The findings are consistent with Zulfikar et.al (2021) and Pongpanich et al. (2009) who found usefulness to be the primary reason of using simulation games in classrooms. One of the reasons for not using simulation games is their lack of usefulness or poor fit with the courses being taught (Jääskä & Aaltonen, 2022). Management teachers generally have concerns about the ability of simulation games to facilitate the teaching process (Vos & Brennan, 2010). The teachers use a simulation game while teaching a course, when they feel that it will help them achieve the learning outcomes. The perception that simulation games can enhance their teaching effectiveness, develops a positive attitude in them, and hence they become more inclined towards adopting them.

4.2. Perceived ease of use and perceived usefulness influence teachers' attitude and their intention to adopt simulation games

The findings also argue for a significant impact of perceived ease of use on perceived usefulness as well as teachers' attitude. The same results were derived in the original TAM studies (Davis, 1989; Venkatesh & Davis, 1996). The findings are also in line with Fagan et al. (2012) who found that perceived ease of use significantly predicts the perceived usefulness of virtual reality simulation. The findings also indicate that perceived ease of use is a strong indirect predictor of teachers' intention to adopt simulation games. This finding is in line with that of Vos and Brennan (2010) who found that lack of necessary skills among marketing lecturers is a key barrier to adopt simulation games. Management teachers are generally not very tech-savvy because of which they may find difficulty in using technology-based simulation games. In a survey carried out by Jääskä and Aaltonen (2021), it was found that majority of the teachers stopped using business simulation games because of the requirement of long preparation time. Hence, the management teachers are more likely to adopt simulation games if they feel that they can easily become skillful at using them.

4.3. Training opportunities positively influence perceived ease of use and perceived usefulness of simulation games

With regards to the external variables, training has been found to be a strong determinant of perceived usefulness as well as perceived ease of use. It is also being observed as an indirect determinant of teachers' attitude and their intention to adopt simulation games. This implies that if teachers get enough training on the simulation games, they will understand their educational benefits and hence will be more likely to adopt them. Training can also help them in becoming skillful at using simulation games. Vos and Brennan (2010) opined that management teachers find searching for and evaluating relevant simulation games to be a cumbersome and time-consuming process. Lack of information on simulation games acts as a significant barrier for the teachers in business schools to adopt them as teaching tools (Beuk 2016; Lester et.al 2023). Proper training can familiarize teachers with the simulation games and their learning benefits. Hence training can develop a positive attitude towards simulation games which can in turn motivate teachers to adopt them.

4.4. Top management support positively influences perceived ease of use and perceived usefulness of simulation games

Top management support has also been found to be a direct determinant of perceived usefulness and perceived ease of use, as well as an indirect predictor teachers' attitude and their intention to adopt simulation games. This implies that top management of educational institutions plays an effective role in convincing and motivating their teachers to adopt innovative technology-based teaching pedagogies. The findings are in line with the previous research (Beuk 2016; Dale et.al, 2021) that have highlighted the lack of institutional support (in terms of resources and time) as one of the key barriers in adopting simulation games in business schools. Teachers in higher educational institutions are generally under pressure to meet the growing expectations of research, because of which they find it difficult to take out time for learning new teaching techniques (Lester et al., 2021; Jääskä & Aaltonen, 2022). Top management's commitment and continuous support (such as providing necessary infrastructure, monetary support, administrative support and time) helps in developing conducive environment for adoption of simulation games.

4.5. Self-efficacy positively influences perceived ease of use

The findings further indicate significant direct influence of teachers' self-efficacy on perceived ease of use. Teachers' who are well versed with digital skills find simulation games easy to use. Their technical capabilities make them confident in integrating technology-based simulation games with their traditional teaching methods. The findings also suggest significant indirect effects of teachers' self-efficacy on perceived usefulness, attitude and intention to adopt simulation games. However, the indirect effects are relatively weak as compared to other variables viz. top management support and training opportunities. The findings are in line with those of Pongpanich et al. (2009) and Faria and Wellington (2004) that indicate technical issues as a less important reason for not using simulation games in business schools.

5. CONCLUSIONS

Because of their numerous learning benefits, simulation games are widely used in business and management programmes. With the advent of new technologies such as artificial intelligence, virtual reality, augmented reality and hybrid reality, technology-based simulation games are gaining popularity because of their flexibility, realism, and engagement. This study's main purpose was to investigate the factors affecting adoption of technology-based simulation games by teachers in business schools. In order to explore the influencing factors, the study extended the widely used TAM framework with two institutional factors namely, top management support and training; and one individual factor, i.e. self-efficacy. The findings indicated that teachers' behavioural intention to adopt simulation games was determined by the perceived usefulness of simulation games and their attitude towards the simulation games. The findings further indicated that teachers' attitude was determined by the perceived ease of use and perceived usefulness of simulation games. It was also found that the top management support and training opportunities provided by the educational institutions significantly influenced the teachers' perceptions of usefulness and ease of using simulation games. Moreover, teachers' self-efficacy was also found to be a significant determinant of their perceptions of the ease of using simulation games.

Premised in India, the study contributed to the literature by putting forward the perceptions of management teachers within Indian contexts. Given the challenges of India pertaining to the infrastructural resources, the present study tried to highlight the key concerned areas of the adoption of business simulation games in management education. The study contributed to the better understanding of viewpoints of teachers, who play pivotal role in introducing innovative technology-based teaching techniques in classrooms. By proposing an extended TAM model, the study contributed to the knowledge of educational technology adoption regarding technology-based simulations for teaching.

5.1. Limitations and future lines of research

This study has limitations with regards to the usage of limited set of variables in the proposed model. Future research may consider including other factors such as compatibility issues, personal innovativeness of teachers, and other environmental factors viz. social influence and subjective norms. Another direction for further research could be to investigate the perceptions of top management of business schools regarding the integration of technology-based simulation games in teaching and learning processes. A qualitative research using in-depth interviews of top management / decision makers can be conducted to understand the challenges and driving forces of adopting simulation games based on innovative technologies in formal management education.

6. FUNDING

No funding was received.

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