MODELLING E-LEARNING ACCEPTANCE OF CLINICAL STAFF USING THE GENERAL EXTENDED TECHNOLOGY ACCEPTANCE MODEL FOR E-LEARNING

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ABSTRACT
Companies still increasingly rely on online training to train employees continuously, effectively, and efficiently. The intention of employees in using e-learning, however, is influenced by various factors. In this study, the influence of external factors on the acceptance of online training was examined in an operational context according to the General Extended Technology Acceptance Model for E-Learning. In this model, computer experience, computer self-efficacy, computer anxiety, perceived enjoyment, and subjective norm were included as important external factors that have been shown to be relevant in numerous empirical studies. In operational contexts, few studies to date have investigated the acceptance model and even less in Europe or Germany. To investigate the influence of external factors, data of 113 employees from a medical institution were collected after participation in an online training course by means of an online questionnaire and were evaluated by regression analyses. The predictors computer experience, perceived enjoyment, and subjective norm were the strongest predictors of perceived usefulness ($R^2 = 0.59$ of the complete model). The perceived ease of use was best explained by the factors computer experience, computer self-efficacy, computer anxiety, and enjoyment ($R^2 = 0.43$ of the complete model). The attitude towards using e-learning and the intention to use e-learning in this study were mainly influenced by perceived usefulness ($R^2 = 0.67$ and $R^2 = 0.59$ of the complete models, together with perceived ease of use). Overall, the acceptance model was largely confirmed in this study.
Keywords: Technology Acceptance Model, General Extended Technology Acceptance Model for E-Learning, computer-related experience, computer anxiety, computer self-efficacy, subjective norm, perceived enjoyment.

Introduction

Technology acceptance is concordantly considered the key to technological progress and spread of innovations in many domains, and it is also considered a core factor for using technology in education (e.g., Nistor, 2018). Particularly in this sector, the idea of rapidly increasing usage of e-learning environments is often emphasized (e.g., Allen & Seaman, 2016; Paechter et al., 2010). For example, Stiller and Bachmaier (2018) stated that “distance and online learning have become common and reputable educational methods in vocational and higher education” (p. 1). Also, Abdullah and Ward (2016) summarized that “e-learning systems have become an important part of delivering the modern university curriculum” (p. 238). Statements like these suggest that technology has been accepted and embraced in the educational sector. Although these statements might be valid, some astonishing evidence can be found to the contrary.

Focusing on the European and German markets and their enterprises, we could find the following evidence. Crossknowledge et al. (2016), for example, conducted a study on digital learning in European companies. From the top 1,000 largest companies in Europe, 114 were surveyed. They found that all companies were already using e-learning at the time of the survey, but e-learning often covered only a small proportion of further education. For example, 46% of the German companies reported that e-learning accounted for only 5% of all continuing vocational training in enterprises. Similar results were achieved in a study by the HHL Leipzig Graduate School of Management, the Stifterverband, and the e-learning provider Lecturio. They surveyed 245 companies and 184 universities in Germany on current trends in the field of continuing training between May 2016 and January 2017 (Kirchgeorg et al., 2018). Although e-learning had a high status in 98% of the companies, the share of e-learning in the total continuing vocational training of companies was only 10% in 59% of the companies surveyed (Kirchgeorg et al., 2018). These results point to a low level of use and thus possibly a low level of acceptance despite the attributed relevance.

One aspect in Germany that supports the assumption of low technology acceptance is that the majority of traditional classroom courses are preferred to e-learning (Crossknowledge et al., 2016). Siepmann and Fleig (2016) surveyed 774 companies on the use of e-learning in continuing vocational training and found that 57% of the companies stated that the acceptance of traditional classroom courses is higher than for e-learning. This might evidence that a successful adaptation of e-learning in a company is not only influenced by organizational factors, but also significantly by the willingness of the employees (Stieglitz, 2015). Irrespective of the advantages and potentials of e-learning, one way to further the acceptance of e-learning in the workplace is to identify all relevant factors that explain acceptance of e-learning and technology.

Acceptance research plays a particularly important role in the adaptation of new information and communication technologies, given that its implementation is usually associated with high investment costs (Frankfurth, 2010). In the last decades, the importance and relevance of the topic has increased, and active efforts have been made to detect important factors (Abdullah & Ward, 2016; Baki et al., 2018; King & He, 2006; Schepers & Wetzels, 2007; Scherer et al., 2019; Šumak et al., 2011). A well-developed knowledge foundation from published studies on the subject of acceptance of e-learning can help with its implementation and contribute to the successful adoption of e-learning by learners (Lee, 2010). Contributing to this knowledge, we conducted a study based on the General Extended Technology Acceptance Model for E-Learning (GETAMEL; Abdullah & Ward, 2016). The model proposes the following five external factors: computer-related experience, computer self-efficacy, computer anxiety, perceived enjoyment, and subjective norm. These five factors are assumed to predict perceived ease of use of an e-learning system and its perceived usefulness, which both determine the attitude and intention to using a system. In operational contexts, few studies to date have investigated these factors (Chipps et al., 2015). Thus, in this study, we investigated whether the influence of the five external factors on the acceptance of an online training according to the GETAMEL (Abdullah & Ward, 2016) can be replicated in an operational context.

The General Extended Technology Acceptance Model for E-Learning (GETAMEL)

From a social science perspective, the term acceptance is understood as the acceptance or rejection of an innovation by one or more users (Reichwald, 1982; Simon, 2001). Innovations are new products or services (Kollmann, 1998). According to Simon (2001), acceptance and rejection are contradictory, which is why acceptance must be regarded as a positive acceptance decision of an innovation by a user (Frankfurth, 2010). Acceptance includes the purchase or adoption of the innovation but also its subsequent use (Bürg et al., 2005). In the context of technology acceptance, the definition by Müller-Böling and Müller (1986; Nistor, 2018) has established itself in current research. They conceptualized technology acceptance as a two-dimensional construct consisting of an attitude and a behavioral component. The attitude component comprises an affective as well as a cognitive component (Frankfurth, 2010; Kollmann, 1999; Moore & Benbasat, 1991; Nistor, 2018; Simon, 2001). Affective refers to the motivational and emotional aspects, such as the rejection of a technology on the basis of fears, whereas the cognitive component weighs the costs and benefits of an innovation against the individual context (Bürg et al., 2005). The observable behavior towards an innovation, specifically the use of an innovation, is defined as behavior acceptance (Müller-Böling & Müller, 1986). In summary, acceptance research differentiates between attitudes and behavioral aspects, that is, between attitude towards behavior and behavior itself (Bürg et al., 2005; Nistor, 2018).

Acceptance models explain which characteristics comprise the latent construct of acceptance and which factors influence it (Jokisch, 2009). Accordingly, the GETAMEL was proposed by Abdullah and Ward (2016). At the core of the GETAMEL is the widespread and well-known Technology Acceptance Model (TAM) introduced by Davis (1986). The TAM is one of the most researched models to explain and predict the acceptance and usage of e-learning (Šumak et al., 2011). Ample evidence has shown the model to be valid and robust with good explanatory power (King & He, 2006; Schepers & Wetzels, 2007; Scherer et al., 2019; Šumak et al., 2011). In addition, Abdullah and Ward's (2016) meta-analysis extracted the five most prominent external factors influencing technology acceptance from the empirical TAM-based literature: (1) Computer-related experience, (2) self-efficacy, (3) computer anxiety, (4) social norm, and (5) perceived enjoyment. The extracted external factors, their estimated effect sizes (averaged path coefficients β from studies using Structural Equation Modelling or Multiple Regression Analysis), and the TAM together build the GETAMEL (see Fig. 1).

Perceived usefulness (PU) and perceived ease of use (PEoU) are the most important constructs in the TAM (King & He, 2006; Schepers & Wetzels, 2007; Scherer et al., 2019; Šumak et al., 2011). PU is defined according to Davis (1989) as "the degree to which a person believes that using a particular system would enhance his or her job performance," whereas PEoU is defined as "the degree to which a person believes that using a particular system would be free of effort" (p. 320). PU represents the subjective assessment of a person as to how far a specific system can increase work performance and PEoU the subjective assessment of how much effort is required to use the system. Whether an e-learning platform is accepted or rejected and thus used or not is largely determined by these two factors (King & He, 2006; Schepers & Wetzels, 2007; Scherer et al., 2019; Šumak et al., 2011). TAM assumes that (1) PEoU directly influences PU, (2) PEoU and PU influence the attitude towards using a technology (AtU), (3) AtU then influences the behavioral intention to use the technology (ItU), and (4) ItU further influences the actual technology use (AU). In addition, PU is also assumed to directly affect ItU. The meta-analyses of King and He (2006), Schepers and Wetzels (2007), Scherer et al. (2019), and Šumak et al. (2011) provided evidence for TAM and its assumptions.

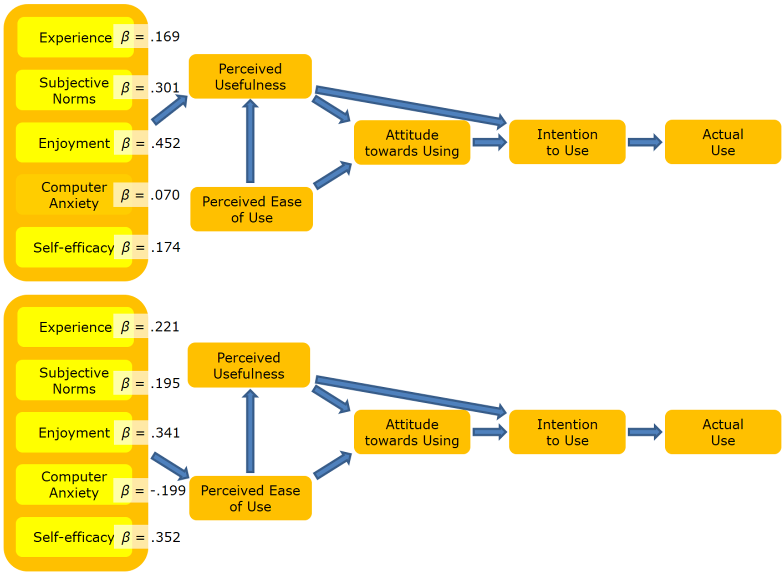

Figure 1: The GETAMEL with the average path coefficients found between the external factors and perceived usefulness (upper image section) and perceived ease of use (lower image section) of e-learning systems. The model refers to (university and college) students (Abdullah & Ward, 2016).

However, according to TAM, PEoU and PU in turn are influenced by external factors (Abdullah & Ward, 2016; Baki et al., 2018). External factors thus play a crucial role in explaining technology adoption behavior (Abdullah & Ward, 2016; Baki et al., 2018). Mathieson (1991) argued that TAM can only provide a rough explanation of the user's attitude towards new information and communication technologies because of a lack of external factors. Obtaining specific information about these factors is more important for identifying ways to improve and further develop the introduction of e-learning. If the TAM is extended by external factors, not only can the use of technology be predicted, but an explanation can also be provided for why a system is not accepted by users (Abdullah & Ward, 2016). Using this information, appropriate measures can be derived to improve acceptance (Davis et al., 1989). For this reason, the TAM has been extended with various external factors in acceptance research to learn more about the acceptance and usage behavior of e-learning (Abdullah & Ward, 2016; Baki et al., 2018).

Abdullah and Ward (2016) developed the GETAMEL out of the necessity to consider external factors. For this purpose, 107 studies were examined in a meta-analysis that had focused thematically on the introduction of e-learning and had used the TAM supplemented by external factors. Only factors that had been analyzed and confirmed in at least 10 studies on the TAM were considered. Abdullah and Ward (2016) extracted five variables out of 152 external variables that were the strongest significant predictors of PEoU and PU: Computer-related experience (CEXP), computer-related self-efficacy (CSE), computer anxiety (CANX), subjective norm (SN), and perceived enjoyment (PENJ) were the most frequently used and confirmed external variables. With the GETAMEL, Abdullah and Ward (2016) attempted to develop a universal model for investigating technology acceptance to unite the different results of previous research. In the following sections, the external factors listed in the GETAMEL and used in this paper are defined and their empirical relevance is worked out.

Computer-related experience (CEXP)

Individual characteristics, such as previous experiences with computers and information systems and the emotional status in the use of computers, have a direct or indirect impact on system use through beliefs (Lee, Hsieh & Ma, 2011; Lee, Hsieh & Chen, 2013). CEXP is defined as the amount and type of computer knowledge an individual acquires over time (Smith et al., 1999). Previous research has shown that CEXP is positively related to the adaptation of systems (Al-alak & Alnawas, 2011; Sun & Zhang, 2006). The higher the expertise, the higher the acceptance. Acceptance is thus dependent not only on the technology but also on the abilities and expertise of the individual (Lee, Hsieh & Chen, 2013). According to King and He (2006), experience is the most researched moderator variable of the TAM. Various studies have confirmed a positive influence of CEXP on both PEoU (De Smet et al., 2012; Lee, Hsieh & Ma, 2011; Lee, Hsieh & Chen, 2013; Purnomo & Lee, 2013) and PU (Lee, Hsieh & Chen, 2013; Martin, 2012; Purnomo & Lee, 2013; Rezaei et al., 2008). People with more computer skills and expertise tend to have more positive feelings about the PEoU and PU of an e-learning system (Lee, Hsieh & Chen, 2013; Purnomo & Lee, 2013). The current findings show that individual computer experiences have a positive and significant influence on the intended use of e-learning or e-learning systems (Al-alak & Alnawas, 2011; De Smet et al., 2012; Premchaiswadi et al., 2012; Williams & Williams, 2010).

Computer-related self-efficacy (CSE)

According to Bandura (1982), self-efficacy is the conviction that certain situations and challenges will be successfully mastered. The construct of self-efficacy is believed to have an important role in the introduction of e-learning because the assessment of self-competence influences whether an action begins, the level of intensity in performing the action, and the stamina needed to complete the action (Abdullah et al., 2016; Bhatiasevi, 2011; Brown et al., 2006; Park, Nam, & Cha, 2012).

In the context of computer use, CSE describes the conviction that certain activities on the computer will be performed successfully (Shen & Eder, 2009; Strong et al., 2006). People who dare not solve tasks with a PC will avoid this tool (Igbaria & Iivaria, 1995), whereas for people with a high CSE, a high use of computers can be expected (Compeau & Higgins, 1995). This statement suggests that a high level of CSE has a positive effect on the intended use, whereas a low level of CSE is more likely to manifest itself in avoidance behavior (Hsia & Tseng, 2008; Moghadam & Bairamzadeh, 2009; Yuen & Ma, 2008). CSE also plays a crucial role in the assessment of PEoU and PU because the extent that people trust their computer-related skills and knowledge will have a significant influence on whether an individual perceives a new system as difficult or simple and how useful it will be (Abdullah & Ward, 2016; Hayashi et al., 2004; Lee et al., 2014; Madorin & Iwasiw, 1999; Venkatesh & Davis, 1996).

Finally, various types of self-efficacy in the context of online learning environments have been proposed. Among the most popular are CSE, self-efficacy on the Internet (ISE), and learning management system self-efficacy (Alqurashi, 2016). When the focus is specifically on learning on the Internet, the ISE is recommended because it assesses online learning skills (Tsai et al., 2011). In this study, the CSE was used because the use of online training requires more skills from the learner than the mere use of the Internet or a learning management system (Shen & Eder, 2009; Strong et al., 2006).

Subjective norm (SN)

Another external factor that has often been studied in acceptance research and identified as playing an important role in PEoU and PU is the SN (Al-Gahtani, 2016; Farahat, 2012; Park, 2009). SN is the extent to which people are convinced that others who are important to them think that they should or should not use the system (Fishbein & Ajzen, 1975; Venkatesh & Davis, 2000). Some researchers have argued that when an individual's peer group thinks that the use of an e-learning system is beneficial, the positive attitude is adopted by the individual (Abdullah et al., 2016; Cheng, 2011; van Raaij & Schepers, 2008). Results of current acceptance research show a positive and significant influence of SN on PU (Abdullah & Ward, 2016; Al-Ammary & Hamad, 2008; Karaali et al., 2011; Rejón-Guardia et al., 2013) and PEoU (Farahat, 2012; Lee, Hsieh & Ma, 2011; Motaghian et al., 2013; Yuen & Ma, 2008). SN as a factor is intended to examine the extent that the decision to use e-learning depends on the social influence of the environment.

Perceived enjoyment (PENJ)

Enjoyment is defined as the degree of pleasure a person experiences when using a specific system (Park, Son, & Kim, 2012). Performance successes resulting from the use of the system is not taken into account. Numerous studies have found that a high level of enjoyment in using the technology leads to a higher acceptance of e-learning (Al-Ammary et al., 2014; Al-Gahtani, 2016; Chen et al., 2013; Shyu & Huang, 2011; Zare & Yazdanparast, 2013). When a system is fun to use, the user is more likely to positively evaluate the system as being useful and easy to use (Al-Aulamie et al., 2012; Chen et al., 2013; Zare & Yazdanparast, 2013) and more likely to use the system (Cheng, 2011, 2012; Lee et al., 2005; Yang & Lin, 2011). This statement is supported by studies that have demonstrated a significant effect of PENJ on PEoU (Al-Aulamie et al., 2012; Shyu & Huang, 2011; Zare & Yazdanparast, 2013) and PU (Chen et al., 2007; Wu & Gao, 2011; Zhang, Guo & Chen, 2007). PENJ thus represents an antecedent for PU and PEoU (Chen et al., 2013).

Computer anxiety (CANX)

Blignaut et al. (2005) defined CANX as "a diffuse, unpleasant, and vague sense of discomfort and apprehension when confronted by computer technology or people who talk about computers" (p. 500), which according to them, comprises "an array of emotional reactions, including fear, apprehension, uneasiness, and distrust of computer technology in general" (p. 495). Correspondingly, Igbaria and Parasuraman (1989) described CANX as "the tendency of an individual to be uneasy, apprehensive, or fearful about the current or future use of computers in general" (p. 375). CANX means fears or anxieties that arise when a person is confronted with situations in which they need to use a computer (Igbaria & Parasuraman, 1989).

According to Oyedele and Simpson (2007), CANX occurs because of a lack of experience and self-efficacy in dealing with the system. This lack in turn has a negative effect on the intended use and thus on the adaptation of an information system. An opposite view can often be found in studies about distance learning. These studies assume that anxiety directly influences self-efficacy, which influences computer usage and performance (Desai, 2001; Hauser et al., 2012; Saadé & Kira, 2009; Sam et al., 2005). Despite the different assumptions, empirical findings show that a high CANX leads to less frequent use or avoidance of an e-learning system (Al-alak & Alnawas, 2011; Al-Gahtani, 2016; Ali et al., 2013; Calisir et al., 2014; Chen & Tseng, 2012; Karaali et al., 2011; Lefievre, 2012; Park, Son, & Kim, 2012; Saadé & Kira, 2006; van Raaij & Schepers, 2008). Previous research on TAM has shown a negative correlation between CANX and the PEoU (Abdullah & Ward, 2016; Al-Gahtani, 2016; Ali et al., 2013; Baki et al., 2018; Hackbarth et al., 2003; Lefievre, 2012; Saadé & Kira, 2006; Venkatesh, 2000) and PU (Chen & Tseng, 2012; Igbaria, 1993; Igbaria & Iivari, 1995; Ifinedo, 2006; Liu, 2010; Mohamed & Karim, 2012; Saadé & Kira, 2006; Roberts & Henderson, 2000). Abdullah and Ward (2016), however, found a significant negative correlation between CANX and PU in only two out of seven studies in their meta-analysis, which is why this connection was excluded from the GETAMEL. Current studies such as those by Chang et al. (2017), however, confirm a significant negative correlation. In addition, CANX was also related to higher dropout (Stiller & Köster, 2016, but also see Long et al., 2009; Stiller & Bachmaier, 2017a, 2017b), and lower performance levels (Desai, 2001; Hauser et al., 2012; Saadé & Kira, 2006; Sam et al., 2005; Stiller & Bachmaier, 2018).

Empirical Evidence for the GETAMEL

We expected a trove of studies, following the publication of the GETAMEL and its five external factors by Abdulla and Ward (2016), to test the model, but were astonished to find only eight (see Table 1). The aim of all studies was to examine the influence of the predictors of CEXP, CSE, CANX, SN, and PENJ on PEoU and PU, and on the resulting attitude or intention towards using (AtU and ItU) a new technology, and sometimes the actual usage (AU). All studies used Structural Equation Modelling (Partial Least Squares). Tables 2 and 3 show the results for PEoU and PU, and Table 4 shows the results for AtU, ItU, and AU. The results of the eight studies are each detailed in the following review.

Table 1: Overview of GETAMEL studies.

	Paper authors	Sample	N	Nation	Analysis
1	Abdullah et al. (2016)	University students	242	England	Structural Equation Modelling
2	Chang et al. (2017)	University students	714	Azerbaijan	Structural Equation Modelling
3	Doleck et al. (2018)	College students	132	Canada	Structural Equation Modelling
4	Hajiyev (2018)	University students	698	Azerbaijan	Structural Equation Modelling
5	Kimathi & Zhang (2019)	University students	172	Tanzania	Structural Equation Modelling
6	Rizun & Strzelecki (2020)	University students	1692	Poland	Structural Equation Modelling
7	Cicha et al. (2021)	University students	664	Poland	Structural Equation Modelling
8	Matarirano et al. (2021)	University lecturers	101	South Africa	Structural Equation Modelling

Abdullah et al. (2016) investigated the influence of the five external factors according to the GETAMEL on PEoU, PU, and behavioral ItU. Undergraduate university students who worked with e-portfolios were surveyed. The results of the study show that CEXP, followed by PENJ, CSE, and SN explained significant variance in the PEoU of e-portfolio handling most strongly. The PU, however, could best be predicted by the PENJ and PEoU. In addition, the ItU e-portfolios could be predicted by PEoU and PU, resulting in 58% explained variance of ItU. In sum, Abdullah et al. (2016) judged the GETAMEL as a robust and adequate model as shown by the goodness of fit test of the research model. They also pointed to some unexpected results and limitations of their method that needed to be further explored. First, against their expectations, CANX was uncorrelated with PEoU. They suggested that an overall low level of CANX could be the cause because of surveying students from computer-related courses. Second, CEXP and CSE were unexpectedly uncorrelated with PU, which was attributed to characteristics of the e-portfolio that they used and the sample of students from computer-related courses. Overall, GETAMEL seems to better explain PEoU than PU in this study.

Chang et al. (2017) reviewed the GETAMEL, surveying 714 undergraduate students using e-books at universities in Azerbaijan. Chang et al. used the e-book definition by Ngafeeson and Sun (2015), stating that e-books are “a piece of electronic text, regardless of size or digital object used, made available digitally for any device that uses a screen for the purpose of instruction and learning” (p. 56). The results of the study show that CEXP, followed by PENJ, CSE, and CANX, could explain the PEoU of the e-book. SN had no effect on PEoU. The PU could best be predicted by the PENJ, CANX, CEXP, and SN. CSE had no effect on PU. PEoU had no significant influence on PU. Furthermore, PEoU and PU were significant predictors of ItU. In sum, Chang et al (2017) judged the GETAMEL as a robust and adequate model as shown by the goodness of fit test of the research model. They also pointed to some aspects that needed to be addressed in future studies. First, a negative correlation was also found between CANX and PU, although CANX was not included in the Abdullah and Ward (2016) study as a predictor of PU in their GETAMEL because of showing mixed effects on PU. Second, unexpectedly, SN was uncorrelated with PEoU, and CSE was uncorrelated with PU.

Table 2: Overview of the results from the GETAMEL studies on PEoU.

	PEoU	CEXP	CSE	CANX	SN	PENJ
	Abdullah & Ward (2016)	.221	.352	-.199	.195	.341
1	Abdullah et al. (2016)	.421+	.196***	-.017	.157*	.286***
2	Chang et al. (2017)	.496**	.246**	-.151*	.025	.239*
3	Doleck et al. (2018)	.114*	.573***	-.128+	.012	.162*
4	Hajiyev (2018)	.169*	.029	-.284**	.009	.013
5	Kimathi & Zhang (2019)	-.07*	.03	.23***	.10**	.15**
6	Rizun & Strzelecki (2020)	.208*	.288*	-.005	--	.329*
7	Cicha et al. (2021)	.271*	.337*	.027	-.037	.315*
8	Matarirano et al. (2021)	.032	.444***	-.161*	.027	.289**

*Notes: *** ≤ .001; ** ≤ .01; * ≤ .05; + ≤ .10; -- = was not explored; a green background indicates a GETAMEL consistent result; a red background indicates a GETAMEL contradictory result*

Table 3: Overview of the results from the GETAMEL studies on PU.

	PU	CEXP	CSE	CANX	SN	PENJ	PEoU
	Abdullah & Ward (2016)	.169	.174	.070	.301	.452	--
1	Abdullah et al. (2016)	-.191	-.141	--	.123	.365***	.602***
2	Chang et al. (2017)	.181**	.026	-.191*	.213**	.321***	.046
3	Doleck et al. (2018)	.110+	-.092	--	.035	.526***	.109
4	Hajiyev (2018)	.181*	.335***	-.191*	.213**	.323***	.008
5	Kimathi & Zhang (2019)	-.04	-.03	.12***	.25***	.01	.15**
6	Rizun & Strzelecki (2020)	-.102*	.133*	-.095*	--	.645*	.099*
7	Cicha et al. (2021)	-.137*	.194*	-.016	.154*	.587*	.023
8	Matarirano et al. (2021)	.159	-.010	--	.016	.080	.258*

*Notes: *** ≤ .001; ** ≤ .01; * ≤ .05; + ≤ .10; -- = was not explored; a green background indicates a GETAMEL consistent result; a red background indicates a GETAMEL contradictory result*

Table 4: Overview of the results from the GETAMEL studies on AtU, ItU, and AU.

		AtU by		ItU by			AU by
		PU	PEoU	PU	PEoU	AtU	ItU
1	Abdullah et al. (2016)	--	--	.689***	.208*	--	--
2	Chang et al. (2017)	--	--	.241**	.205*	--	--
3	Doleck et al. (2018)	.635***	.300***	.187*	--	.581***	.665***
4	Hajiyev (2018)	.427**	.340**	.277**	--	.454**	--

		*	*	*		*	
5	Kimathi & Zhang (2019)	--	--	.26**	.22**	--	--
6	Rizun & Strzelecki (2020)	.581*	.277*	.233*	--	.638*	.642*
7	Cicha et al. (2021)	.673*	.180*	.311*	--	.494*	.688*
8	Matarirano et al. (2021)	.710***	.126	.38**	.023	.294+	.410***

*Notes: *** ≤ .001; ** ≤ .01; * ≤ .05; + ≤ .10; -- = was not explored*

Doleck et al. (2018) tested GETAMEL in the context of e-learning with college students (N = 132). The relationships in the postulated model were examined by PLSSEM. The results of the study show that CSE, followed by PENJ, CANX and CEXP explained significant variance in the PEoU. SN had no effect on PEoU. The PU was best predicted by the PENJ. CEXP, SN, and CSE were not significant predictors of PU. PEoU had also no significant influence on PU. In addition, PEoU and PU were significant predictors of AtU, and AtU and PU predicted ItU, and ItU predicted AU. Overall, the findings showed that the external factors of the GETAMEL could predict the core variables of TAM adequately, although not all factors were relevant for the specific model in the study. Thus, Doleck et al. (2018) question the generalizability of the GETAMEL on the basis of their results. They assumed that situational factors, such as voluntariness or personal convictions, have a far greater influence on the intended use than the TAM core constructs (PEoU and PU).

Hajiyev (2018) examined the GETAMEL with undergraduate students (N = 698) using mobile learning in higher education in Azerbaijan. The collected questionnaires were analyzed using a structural equation model. Given the focus on mobile learning, Hajiyev replaced CANX with information and communication technologies anxiety (ICTA). Hajiyev also judged the GETAMEL as a robust and adequate model as shown by the goodness of fit test of the research model, but not all relationships between the five proposed predictors and the TAM constructs PEoU and PU were significant. All five external factors explained significant variance in PU, but only CEXP and ICTA were significant predictors of PEoU. Furthermore, PEoU and PU were significant predictors of AtU, and PU and AtU predicted the behavioral ItU mobile learning. Hajiyev (2018) concluded that PU plays a far greater role in mobile learning than PEoU.

Kimathi and Zhang (2019) examined the GETAMEL with undergraduate students (N = 172) using e-learning in higher education in Tanzania. Questionnaire data were analyzed using structural equation modelling. Kimathi and Zhang also judged the GETAMEL as a robust and adequate model as shown by the goodness of fit test of the research model, but not all relationships between the five proposed predictors and the TAM constructs PEoU and PU were significant. Only two factors played a significant role in predicting PU, SN and CANX, and four factors in predicting PEoU, SN, CEXP, PENJ, and CANX. In addition, the ItU e-learning was predicted by PU and PEoU. PEoU was also significantly related to PU. Some questions arise looking at the data of Kimathi and Zhang. First, the means of items seem to be incorrect because there are many item means at the end of the scoring range = (5) or even above with comparable high SDs (approx. 1.00). Second, the correlations between variables are very different from all other GETAMEL studies. Only few notable small- to medium-sized correlations are shown compared to other studies that reported more significant, stronger correlations. Thus, the reliability of the analysis is questionable.

Rizun and Strzelecki (2019) tested the GETAMEL in the context of distance learning adoption in the COVID-19 pandemic with undergraduate and graduate university students at a Polish university (N = 1,672). SN was omitted from the investigation because of "the mandatory character of distance course during COVID-19 pandemic" (p. 8). The relationships in the postulated model were examined by using PLSSEM. The model was verified. The influence of PEoU, CEXP, CANX, PENJ, and CSE on PU was confirmed. The influence of CEXP, PENJ, and CSE on PEoU could also be confirmed. CANX had no effect on PEoU. In addition, PU and PEoU predicted the behavioral AtU, and AtU and PU predicted the behavioral ItU. ItU also predicted AU.

Matarirano et al. (2021) tested an extended GETAMEL in the context of Blackboard Learning Management System adoption with university lecturers (N = 101) at a South African university, which also included the external factors of job relevance, system accessibility and technical support in addition to the five external factors of GETAMEL. The relationships in the postulated model were examined by using structural equation modeling. The model was only partially verified. The results show that CSE, PENJ, and CANX explained significant variance in the PEoU, whereas SN and CEXP did not. The PU was best predicted by PEoU; None of the five GETAMEL external factors were significant predictors of PU. Furthermore, PU predicted the behavioral AtU but not PEoU, and AtU and PU predicted the behavioral ItU. ItU predicted AU. Overall, the findings show that the external factors of the GETAMEL could not sufficiently predict the core variables of TAM. Thus, Matarirano et al. (2021) question the generalizability of the GETAMEL to lecturers, given that it was developed for students. In another study, the model was partially verified in the context of the COVID-19 pandemic with first-year undergraduate university students in Poland (Cicha et al., 2021). In contrast to the other studies, which investigated the experience of people with a technical system, Cicha et al. (2021) investigated the students' expectations toward online learning before experiencing the technical systems in use at an institution. The influence of CEXP, SN, PENJ, and CSE on PU was confirmed but not CANX. The influence of CEXP, PENJ, and CSE on PEoU could also be confirmed. SN and CANX had no effect on PEoU. Moreover, PU and PEoU predicted the behavioral AtU, and AtU and PU predicted the behavioral ItU. ItU also predicted AU.

In summary, the studies by Abdullah et al. (2016), Chang et al. (2017) and Hajiyev (2018) verified the GETAMEL. Doleck et al. (2018), however, questioned the generalizability of the model because their results could not confirm significant relationships between all five external factors to the core constructs. With the exception of Matarirano et al. (2021), all other studies sampled college-age or university students. Hence, no study exists that has tested the GETAMEL in an entrepreneurial context. This current study is intended to address this research gap.

Research Question And Expectations

The aim of this study was to examine the predictive power of the five external factors as proposed by the GETAMEL on the PEoU and the PU of an e-learning environment about hand hygiene in a clinical operational context. Therefore, data were analyzed by correlations and multiple regression analyses.

We expected that CEXP, CSE, CANX, SN, and PENJ could model the PEoU and the PU of the examined e-learning environment showing a high multiple correlation. Furthermore, according to GETAMEL, CANX, CSE, SN, and PENJ were expected to have a positive relation with both PEoU and PU, and CANX was expected to show a negative relation to PEoU but a non-existing relation to PU.

Previous research has shown a significant relationship between PEoU and PU (Chang et al., 2017), implying that those who find the handling of a new technological system easy also strongly tend to find it useful (Davis, 1986; Davis, 1989; Davis et al., 1989). Thus, a substantial correlation should be revealed in the data.

In addition, according to the TAM, PEoU and PU have a direct influence on AtU, which in turn influences the ItU together with PU. Thus, it was expected that PEoU and PU should model the AtU showing a high multiple correlation. In addition, AtU and PU were expected to account for significant variance in ItU.

To test whether AtU is an essential part of the model, the modelling of ItU by AtU und PU was compared with the modelling of ItU by PEoU und PU. AtU should improve the prediction of ItU.

Method

Sample

The data for analyses were obtained from 120 employees and students from the medical facilities in the Oberpfalz district in the German Federal State of Bavaria. Seven participants provided incomplete data sets. Thus, they were excluded from the analyses. Table 5 shows the descriptive data of the remaining sample of 113 participants. Employees working in the fields of geriatric medicine and forensics and students enrolled in the Vocational School for Nursing and Nursing Assistance participated in the study. The sample consisted of 55.8% females (N = 63) and 44.2% males (N = 50). To guarantee the anonymity of the employees, age needed to be indicated by means of age ranges at the request of the company.

Table 5: The number and percentage of participants in each age and occupational group (N = 113).

Age	N	%	Occupational groups	N	%
15-20	13	11.5	Doctors	9	8.0
21-26	21	18.6	Teachers	1	0.9
27-32	21	18.6	Care and educational services	69	61.1
33-38	8	7.1	Social education workers	4	3.5
39-44	19	16.8	Therapists	6	5.3
45-50	11	9.7	Other groups (including students)	24	21.2
51-56	13	11.5			
57-62	6	5.3			
63-68	1	0.9			

Responding to the questionnaire was not possible without completing the e-learning. Thus, we assumed that 120 respondents participated in both the e-learning and the survey. Only 113 respondents could be included in the analyses because of missing data. The number of dropouts and the number of people who completed the e-learning but did not take part in the questionnaire could not be recorded by the system.

Description of the online training about hand hygiene

The online training thematically explains all important basics of hand hygiene. An instruction about hand hygiene is obligatory for all employees who come into contact with patients and must be completed annually. To date, this has taken the form of classroom training or instruction on the wards. To ensure that every respondent has access to the learning module, it was made available on the in-house learning platform (Moodle). The training was created using the Articulate Storyline 2 authoring tool and comprised seven chapters. To familiarize the learners with interacting and navigating in the online training, all necessary information was conveyed in the first Chapter “Introduction”. In chapters 2-6, the learner was informed about the content: “What is hygienic hand disinfection?”, “When is hand disinfection necessary?”, “How to carry out hygienic hand disinfection”, “Everything about disinfectants”, and “Who has to carry out hand disinfection?” The last Chapter, “Final questions”, contained a 13-items multiple-choice knowledge test. On the last page of the chapter after the knowledge test, respondents were informed to click on a link to the survey about e-learning acceptance and that receiving the training certificate was contingent on completing the survey. The total learning time was estimated at 15 min.

Navigation in the online training was kept simple by a pair of buttons functioning as turning pages. Clicking the next button presented the next page in the page order, and clicking the back button presented the previous page. Clicking the menu button presented an overview of the seven chapters of the online training, which could be clicked on to easily jump to the desired chapter. The structure of a chapter was always the same throughout the entire online training. A chapter consisted of an opening and a closing slide. The former presented the topic and the latter gave the learner the opportunity to recapitulate the learned content before beginning with the next chapter. Between the beginning and end of the chapter, the instruction was presented. Learning questions were implemented in addition to the content to activate users and existing knowledge.

The core instructions of the chapters were videos, that is, spoken text was combined with static and dynamic visualizations. The automatic playback of the videos could be paused with a pause button. For a clear presentation and to improve the practical relevance, pictures from everyday clinic life were mainly used. In addition, the speaker’s text could be presented to the left of the video as online text. Generally, the entire text of the online training, including the instructions, was available as on-screen text and narration. Therefore, the presentation mode - auditory, visual, or in combination - could be freely chosen by the learner.

Procedure and measurements

The study took place from June to August, 2018. Basic information about the project was sent to the employees/students in advance by the station managers of the participating departments. On the 1st of June, 2018, the study started by sending an e-mail with an access link to the online training about hand hygiene, information on the study, and a process description. After activating the access link, the participant was asked to log on to the in-house learning platform (Moodle), whereupon the online training started automatically. An online questionnaire about e-learning acceptance was provided after completing the online training via a link on the last page of the training. The questionnaire could only be completed during working hours because it was only available in the company, as was the online training.

Table 6: Original untranslated items used for measuring the variables.

Scale	Items	Reference
Computer-related experience	I enjoy using computers. Working with a computer would make me very nervous. I get a sinking feeling when I think of trying to use a computer. Computers make me feel uneasy and confused.	Lee et al. (2011)
Computer anxiety	I am worried that I do not know how to make the computer finish the things I want to do. I feel troubled regarding some work that can only be completed by using a computer. When I face error messages on the computer, I do not know what to do. I feel scared in terms of operating products related to computer and	Chen & Tseng (2012)

	technology.	
Computer-related self-efficacy	I could complete my learning activities using the e-learning system if I had never used a system like it before. I could complete my learning activities using the e-learning system if I had only the system manuals for reference. I could complete my learning activities using the e-learning system if I had seen someone else using it before trying it myself. I could complete my learning activities using the e-learning system if I had just the built-in-help facility for assistance.	Compeau & Higgins (1995)
Subjective norm	People who influence my behavior think that I should use the system. People who are important to me think that I should use the system. The senior management of this business has been helpful in the use of the system. In general, the organization has supported the use of the system.	Venkatesh & Bala (2008)
Perceived	I find using the e-learning system to be enjoyable.	Davis et al. (1992)
enjoyment	The actual process of using the e-learning system is pleasant.	Lee et al. (2005)
	I have fun using the e-learning system.	Lee et al. (2005)
Perceived	My Interaction with the system would be clear and understandable.	Venkatesh & Davis
ease of use	Interacting with the system does not require a lot of my mental effort.	(2000)
	I find the system to be easy to use.	
	I find it easy to get the system to do what I want it to do	
Perceived usefulness	Using the e-learning system improves my learning performance. Using the e-learning system enhances my learning effectiveness. Using the e-learning system gives me greater control over learning. I find the system to be useful in my learning.	Cheng (2012)
Attitude	Using the system is a good idea	Calisir et al. (2014)
towards using	Using the system is a wise idea	
	I like the idea of using the system	
	Using the system is unpleasant	
Intension to use	I will use the e-learning system on a regular basis in future. I will frequently use the e-learning system in future. I will strongly recommend others to use the e-learning system.	Cheng (2012)

In correspondence to the GETAMEL, the questionnaire was composed of five scales for assessing the external factors, which are (1) CEXP, (2) CSE, (3) CANX, (4) SN, and (5) PENJ, and four scales for assessing the core constructs of technology acceptance, which are (1) PEoU, (2) PU, (3) AtU, and (4) ItU. Each scale comprised three or four items, which were statements that could be rated on a 5-point Likert scale from "totally disagree" to "totally agree" (see Table 6). The scales were translated into German, and the standard reverse translation method (Mullen, 1995; Sperber et al., 1994) was used to ensure that the original meaning was retained. To ensure the quality of the translation, the results were checked by an independent person. For the operationalization of the constructs, instruments from relevant studies of previous research were used. The 35 selected items are presented in Table 6 together with the corresponding sources.

Table 7 presents the scale features, based on the data of 113 online students. For all scales used in the questionnaire, the individual scores per scale were calculated as means of item ratings. Given that all items were rated on a 5-point Likert scale, all scores ranged between 1 and 5. Higher scores reflect higher feature levels of variables.

Table 7: Means, standard deviations, and the potential score range of the used scales are shown (N = 113).

			Number of items	Score range	*M*	*SD*	Cronbach's alpha
1	Computer-related experience	CEXP	4	1-5	4.40	.60	.82
2	Computer anxiety	CANX	4	1-5	1.74	.76	.87
3	Computer-related self-efficacy	CSE	4	1-5	3.86	1.04	.83

4	Subjective norm	SN	4	1-5	2.72	.89	.70
5	Perceived enjoyment	PENJ	3	1-5	3.63	1.01	.93
6	Perceived ease of use	PEoU	4	1-5	4.13	.70	.85
7	Perceived usefulness	PU	4	1-5	3.42	.93	.93
8	Attitude towards using	AtU	4	1-5	3.94	.89	.89
9	Intension to use	ItU	3	1-5	3.63	1.05	.96

Results
Correlations between variables
Table 8 shows the 36 correlations calculated between the investigated variables. Correlations were tested for significance using non-corrected Alpha levels. We did not apply a cumulative Type I error correction because this procedure would have resulted in substantial number of nonsignificant correlations. Such a procedure would not be helpful with interpreting the results of the subsequent regression analyses.

Table 8: Correlation matrix of variables

			2 CSE	3 SN	4 PENJ	5 CANX	6 PEoU	7 PU	8 AtU	9 ItU
1	Computer-related experience	CEXP	.32***	.24**	.44***	-.71***	.53***	.47***	.53***	.46***
2	Computer self-efficacy	CSE		.16^{+}	.15	-.18^{+}	.32***	.14^{+}	.21*	.15^{+}
3	Subjective norm	SN			.33***	-.14	.21*	.39***	.32***	.33***
4	Perceived enjoyment	PENJ				-.33***	.53***	.74***	.68***	.66***
5	Computer anxiety	CANX					-.48***	-.33***	-.36***	-.36***
6	Perceived ease of use	PEoU						.45***	.50***	.44***
7	Perceived usefulness	PU							.80***	.76***
8	Attitude towards using	AtU								.79***
9	Intension to use	ItU								

Note. $^{+}$ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. 1-5 are external variables, correlations were tested double-sided; 6-9 are dependent variables, correlations were tested single-sided due to the explicit hypotheses.

The pattern of correlations between the external variables is very clear. CEXP correlated with all other external variables reflecting overall medium-sized to large-sized effects (Gignac & Szodorai, 2016). The higher the level of CEXP, the higher the level of CSE, SN, and PENJ but the lower the level of CANX. The correlation between CEXP and CANX was very high. In addition, SN correlated positively with PENJ, and PENJ negatively with CANX. The more online students reported to have important others valuing and supporting e-learning, the higher was their PENJ, and the higher their level of PENJ, the lower their CANX.

Large-sized, positive correlations were found between all dependent acceptance variables (Gignac & Szodorai, 2016). Although PEoU correlated with the other variables in the range between .44 and .50, the correlations between PU, AtU, and ItU were much larger in the range of .76 to .80. Medium-sized to large-sized correlations were mainly found between the external and the predicted variables (Gignac & Szodorai, 2016). Only two of the 20 correlations were not significant, and they were with CSE. Self-efficacy was positively but nonsignificantly correlated with PU and ItU. The strongest correlations with the dependent variables were with CEXP and PENJ.

Regression Analyses
All technology acceptance variables could be modelled by multiple linear regressions with the external factors proposed by Abdullah and Ward (2016) (see Tables 9 and 10). All forced entry models consistently resulted in large multiple correlations between .66 and .82 and an explained variance between .43 and .67.

PEoU was best modelled by CEXP, CANX, CSE, and PENJ. The higher the level of CEXP, CSE, and PENJ, the lower the level of CANX, and the higher the PEoU. PENJ showed the highest predictive power on PEoU. SN played no role in the regression model. This result is attributed to the medium-sized correlations of SN with CEXP and PENJ, overlaying the effect of SN on PEoU as reflected by the small correlation between them.
PU was best modelled by CEXP, PENJ, and SN. The higher the level of CEXP, PENJ, and SN, the higher the PU. Similar to the previous model, PENJ showed the highest predictive power for PU. CANX played no role in the model. This result is attributed to the large-sized correlations of CANX with CEXP (r = -0.71), overlaying the effect of CANX on PU as reflected by the small correlation between CANX and PU (see Table 10).

Table 9: Summary of models

	R	R^2	*Adjusted* R^2	*SE*	*DW*	*F*	df_1	df_2	$p <$
Perceived ease of use	.66	.43	.41	.54	2.11	16.42	5	107	.001
Perceived usefulness	.77	.59	.57	.61	2.23	30.78	5	107	.001
Attitude towards using	.82	.67	.66	.52	1.36	110.76	2	110	.001
Intention to use (by AtU & PU)	.82	.67	.66	.61	1.42	111.21	2	110	.001
Intention to use (by PEoU & PU)	.77	.59	.58	.68	1.45	77.80	2	110	.001

In reference to PU and PEoU as predictors, the resulting models of AtU and ItU were very similar. The higher the PU, the higher the AtU and ItU. PEoU also remained significant in the models, but its influence was only about 20-25% of the effect of PU. In reference to AtU and PU, the resulting model of ItU was strongly predictive. The higher the AtU and PU, the higher the ItU. Despite the high correlation between PU and AtU, PU played a significant role in the model.

Table 10: Results of the multiple linear regression analyses

		B	*SE*	ß	*t*	*df*	*p*	*Tolerance*
Perceived ease of use	(Constant)	2.20	.66		3.33	107	.001	
	Computer experience	.21	.13	.18	1.59	107	.115	.42
	Computer anxiety	-.18	.10	-.20	-1.88	107	.063	.49
	Computer self-efficacy	.11	.05	.17	2.16	107	.033	.88
	Subjective norm	-.01	.06	-.02	-.20	107	.846	.97
	Perceived enjoyment	.26	.06	.37	4.40	107	.001	.75
Perceived usefulness	(Constant)	-.26	.75		-.35	107	.729	
	Computer experience	.28	.15	.18	1.88	107	.063	.42
	Computer anxiety	.02	.11	.02	.22	107	.828	.49
	Computer self-efficacy	-.03	.06	-.03	-.45	107	.656	.88
	Subjective norm	.15	.07	.15	2.21	107	.030	.87
	Perceived Enjoyment	.58	.07	.63	8.70	107	.001	.75
Attitude towards using e-learning	(Constant)	.67	.30		2.22	110	.028	
	Perceived ease of use	.22	.08	.17	2.81	110	.006	.80
	Perceived usefulness	.69	-06	.73	11.82	110	.000	.80
Intention to use e-learning	(Constant)	-.09	.26		-.32	110	.746	
	Attitude towards using	.61	.11	.52	5.64	110	.000	.36
	Perceived usefulness	.38	.10	.34	3.71	110	.000	.36
Intention to use e-learning	(Constant)	.17	.39		.42	110	.676	
	Perceived ease of use	.19	.10	.12	1.81	110	.074	.80
	Perceived usefulness	.79	.08	.70	10.24	110	.001	.80

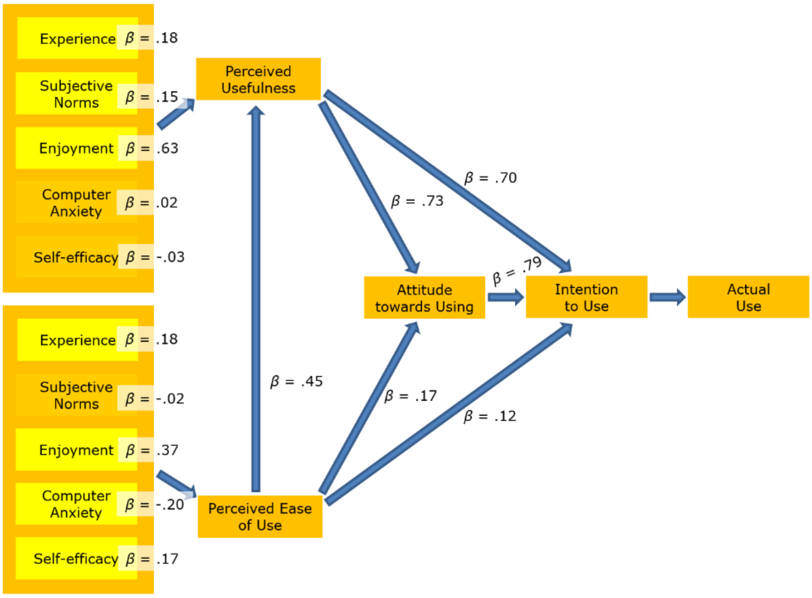

Figure 2: The GETAMEL with the beta coefficients found in this study.

Self-correlation, homoscedasticity, and non-collinearity

The self-correlation of residuals per regression model was tested with the Durbin-Watson test. Values in the interval of 1.5 to 2.5 indicate the non-existence of self-correlations. The value of two out of four of the resulting regression models were within the acceptable range. Hence the absence of self-correlation of residuals is assumed for these models (see Table 9). Three models predicting AtU and ItU lied just below 1.5. Thus, results should be interpreted with caution.

Homoscedasticity, tested by the Koenker test (Koenker, 1981), was not violated for PEoU (λ^2 = 5.80, *df* = 5, *p* = .33), PU (λ^2 = 5.56, *df* = 5, *p* = .35), AtU (λ^2 = 1.90, *df* = 2, *p* = .39), and ItU (modelled by AtU and PU: λ^2 = .85, *df* = 2, *p* = .65, and modelled by PU and PEoU: λ^2 = 2.26, *df* = 2, *p* = .33).

Non-collinearity focuses on the correlations between predictors and could be controlled by the statistic of tolerance. Values smaller than .10 are indicative of collinearity of predictors, and values near 1 are unproblematic. The tolerance indices of all regression models suggest non-collinearity of predictors.

Discussion

The aim of this paper was to review the GETAMEL, focusing on an e-learning environment about hand hygiene in a clinical operational context. Overall, our expectations were confirmed that computer-related experience, computer-related self-efficacy, computer anxiety, social norm, and perceived enjoyment could model the perceived ease of use and the perceived usefulness as indicated by the large multiple correlations and the amount of explained variance. Our findings are in line with the GETAMEL reviews by Abdullah et al. (2016), Chang et al. (2017), Doleck et al. (2018), Hajiyev (2018), and Kimathi and Zhang (2019). However, the results of the present study revealed that not every external factor had the expected relationship to the core constructs of the TAM. This study found the following expected relationships consistent with previous studies:

- Computer-related experience and PEoU (positive)
- Computer anxiety and PEoU (negative)
- Computer-related self-efficacy and PEoU (positive)
- Subjective Norm and PEoU (positive)
- Perceived enjoyment and PEoU (positive)
- Computer-related experience and PU (positive)
- Computer anxiety and PU (like in the GETAMEL, a non-existing relationship was expected)
- Subjective norm and PU (positive)
- Perceived enjoyment and PU (positive)

Note that the relationship of computer anxiety and perceived usefulness was not included in the GETAMEL, but it was analyzed in review studies like Chang et al. (2017), Hajiyev (2018), and Kimathi and Zhang (2019). Subjective norm is listed above because an essential correlation with perceived ease of use was found. All other listed variables were mainly strong correlates and explained significant variance in the regression models. The expected relationships between computer self-efficacy and perceived usefulness were not supported by the results and thus not consistent with previous studies. Self-efficacy was only marginally correlated with perceived usefulness, but it was not a significant predictor in the regression model.

In sum, showing not every external factor as relevant corresponds to the GETAMEL reviews by Abdullah et al. (2016), Chang et al. (2017), Doleck et al. (2018), Hajiyev (2018), and Kimathi and Zhang (2019) and thus seems to be a general result of GETAMEL reviews. Therefore, Doleck et al. (2018) questioned the generalizability of the model. Moreover, it was suggested to expand research to clear inconsistencies as well to consider alternative external factors in face of the diversity of technical applications with various functions (e.g., Abdullah et al., 2016).

As hypothesized and according to the TAM and published studies (Chang et al., 2017; King & He, 2006; Schepers & Wetzels, 2007; Scherer et al., 2019; Šumak et al., 2011), a substantial correlation was found between perceived ease of use and perceived usefulness, suggesting that those who found the handling of the new technological application easy also strongly tend to find it useful (Davis, 1986; Davis, 1989; Davis et al., 1989). Moreover, perceived ease of use and perceived usefulness had also a high predictive power on the attitude towards using the e-learning environment, which together with perceived usefulness was highly predictive of the intended use of e-learning.

The results also show that the attitude and the intention towards using e-learning are equally explained by similar linear multiple regression models comprising perceived ease of use and perceived usefulness as predictors. Perceived usefulness was the strongest predictor in both models. In addition, attitude and intention towards using the e-learning highly correlated. From an empirical perspective, our findings confirm that one of the two TAM components can be omitted, as was proposed in some studies (e.g., Abdullah et al., 2016; Bhatiasevi, 2011; Chen et al., 2013; Giovanis et al., 2012; Hussein et al., 2007; Lee, 2006; Liu, 2010; Macharia & Nyakwende, 2009; Tobing et al., 2008; Venkatesh et al., 2003; Wang & Wang, 2009; Yi & Hwang, 2003). Note that the suggestions in the literature were grounded on weak relationships between the constructs perceived ease of use, perceived usefulness and attitude towards using and weak relationships between attitude and intention towards using. In this study, the attitude measure could be omitted because it failed to increase model fit: Perceived ease of use and perceived usefulness equally well “predicted” attitude towards using and intention towards using.

Perceived enjoyment, perceived ease of use, and perceived usability

Perceived enjoyment is a crucial factor in GETAMEL and other acceptance models (Abdullah & Ward, 2016). In the present study, it was an essential factor for explaining variance in perceived ease of use and perceived usefulness (Abdullah & Ward, 2016). However, it is not a typical external factor like the others that were assessed. Most of external factors in GETAMEL focus on user characteristics (i.e., computer-related experience, computer-related self-efficacy, computer anxiety, social norm), but perceived enjoyment forms only when interacting with a system, similar to perceived ease of use and perceived usability. Thus, excluding perceived enjoyment as an external factor might be preferable because assessing it in advance of technology use to predict technology acceptance is not possible. Instead, it could be moved to the TAM on the level with perceived ease of use and perceived usefulness. Thereby, it might be viewed as an additional variable influencing perceived usefulness together with perceived ease of use but also as an antecedent variable influencing perceived ease of use (Sung & Yun, 2010). Perceived enjoyment assesses the affective-motivational aspect of usage, whereas perceived ease of use assesses the cognitive aspect of effortless usage. According to Sung and Yun (2010), both constructs correlate, resembling, for example, that higher enjoyment leads users to perceive a task as less difficult, which in turn makes users underestimate the task difficulty.

Limitations

The present study had some obvious limitations that must be addressed. First, the sample was generated ad hoc and consisted of the first students encountering the new e-learning training about hand hygiene. Thus, our findings might not generalize to other operational contexts. Second, the measures of variables were not optimal. We administered scales that were frequently used in the empirical literature, but the instruments should be evaluated. For example, inspecting the measures of computer-related experience and computer anxiety, all items of the computer-related experience scale focus on emotions, some of which appear to overlap with items in the computer anxiety measure. Researchers should ensure that measured constructs are orthogonal, which would also make it easier to administer SEM analyses. Third, the cross-sectional design of the study obtained data at one timepoint. Thus, the method does not address variables that change over time while using the system, and it does not address time relations between predictors and predicted variables.

Conclusion

In addition to identifying alternative external factors that could improve the understanding of how technology acceptance develops or expanding the research to address the inconsistencies in the effects of external factors, we recommend another four approaches to investigating technology acceptance to advance empirical knowledge.

(1) More studies are needed that analyze technology acceptance on a single theoretical background (e.g., the GETAMEL) using one sample that is confronted with various technological and functional devices. This method could provide information about the extent of technology acceptance depending on the type of technological device and function. In addition, the technology acceptance data for each device should be obtained by cross-sectional designs. Using the same cross-sectional research design corresponds to the vast majority of research designs used in empirical studies about technology acceptance. This approach could elaborate consistencies and inconsistencies in external factors and the modelled predictors of external factors reported in the literature.

(2) Empirical testing of the model in different teaching contexts is needed (Doleck et al., 2018). The extent that the GETAMEL can be generalized and applied to other online teaching formats (Doleck et al., 2018) is still unknown. Technology acceptance should be explored based on a task analysis that identifies the requirements of appropriate use for users. On the basis of task analyses, technological devices and their purpose could be compared on the level of explicit task dimensions. This approach could provide a better understanding of which user characteristics might affect technology acceptance and on which external factors to regress technology acceptance. Thus, more studies are needed that focus on task analysis.

(3) Consistent with other studies (Goh et al., 2014; Lee et al., 2011; Sek et al., 2010), Granić and Maragunić (2019) indicated a lack of longitudinal studies. Therefore, data for external factors should be collected before participants are confronted with the type of technological advice. Using cross-sectional designs only leads to model fits without grounds for causal interpretations and does not address changes in external factors while experiencing a technological device.

(4) Perceived usefulness and perceived ease of use should not be regressed on perceived enjoyment as an external factor. We consider perceived enjoyment an affective-motivational usability feature, one among other characteristics attributed to a technological experience that develops when interacting with the device. Enjoyment is not a typical user characteristic like computer-related experience, computer-related self-efficacy, computer anxiety or social norm. Therefore, perceived enjoyment might be treated like the TAM core constructs perceived ease of use and perceived usability.

In general, the external factors proposed by the GETAMEL are altogether considered a fruitful starting point for analyzing the influence of external factors on technology acceptance.

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Appendix

Table A: The original English items and their German translations are shown. Items were rated on a 5-point Likert scale coded from 1 (totally disagree = trifft überhaupt nicht zu) to 5 (totally agree = trifft völlig zu)

Scale	Original English items	German items used for the study
Computer experience	I enjoy using computers.	Mir macht es Spaß, Computer zu benutzen.
	Working with a computer would make me very nervous.	Mit einem Computer zu arbeiten, würde mich sehr nervös machen.
	I get a sinking feeling when I think of trying to use a computer.	Wenn ich daran denke, wie ich versuche, einen Computer zu bedienen, bekomme ich ein flaues Gefühl im Magen.
	Computers make me feel uneasy and confused.	Computer beunruhigen und verwirren mich.
Computer anxiety	I am worried that I do not know how to make the computer finish the things I want to do.	Ich mache mir Sorgen, dass ich nicht weiß, wie ich den Computer dazu bringen kann, die Dinge zu erledigen, die ich machen möchte.
	I feel troubled regarding some work that can only be completed by using a computer.	Arbeiten, die nur mit dem Computer durchgeführt werden können, beunruhigen mich.
	When I face error messages on the computer, I do not know what to do.	Wenn ich mit Fehlermeldungen am Computer konfrontiert werde, weiß ich nicht, was zu tun ist.
	I feel scared in terms of operating products related to computer and technology.	Ich habe Angst, Produkte zu nutzen, die in Zusammenhang mit Computer und Technologie stehen.
Computer self-efficacy	I could complete my learning activities using the e-learning system if I had never used a system like it before.	Ich könnte meine Lernaktivitäten mit dem E-Learning-System abschließen, auch wenn ich noch nie zuvor ein E-Learning benutzt hätte.
	I could complete my learning activities using the e-learning system if I had only the system manuals for reference.	Ich könnte meine Lernaktivitäten mit dem E-Learning-System abschließen, wenn ich lediglich die Anleitung zur Hilfe hätte.
	I could complete my learning activities using the e-learning system if I had seen someone else using it before trying it myself.	Ich könnte meine Lernaktivitäten mit dem E-Learning-System abschließen, wenn ich jemanden zuvor bei dessen Verwendung zugesehen hätte.
	I could complete my learning activities using the e-learning system if I had just the built-in-help facility for assistance.	Ich könnte meine Lernaktivitäten mithilfe des E-Learning-Systems abschließen, wenn ich lediglich die im System integrierte Hilfe zur Unterstützung hätte.
Subjective norm	People who influence my behavior think that I should use the system.	Personen, die mein Verhalten beeinflussen, denken, dass ich das ELearning benutzen sollte.
	People who are important to me think that I should use the system.	Personen, die wichtig für mich sind, denken, dass ich das E-Learning nutzen sollte.
	The senior management of this business has been helpful in the use of the system.	Meine Vorgesetzten waren bei der Verwendung des E-Learning hilfreich.
	In general, the organization has supported the use of the system.	Im Allgemeinen unterstützte die Organisation die Nutzung des E-Learning.
Perceived enjoyment	I find using the e-learning system to be enjoyable.	Ich finde, dass das E-Learning sehr unterhaltsam ist.
	The actual process of using the e-learning system is pleasant.	Die tatsächliche Nutzung des ELearning ist angenehm.
	I have fun using the e-learning system.	Ich habe Spaß, das E-Learning zu nutzen.
Perceived ease of use	My Interaction with the system would be clear and understandable.	Der Umgang mit dem E-Learning war klar und verständlich.
	Interacting with the system does not require a lot of my mental effort.	Der Umgang mit dem E-Learning erfordert von mir keine geistige Anstrengung.
	I find the system to be easy to use.	Ich finde das E-Learning einfach zu Bedienen.
	I find it easy to get the system to do what I want it to do.	Ich finde es einfach, das E-Learning dazu zu bringen, das zu tun, was ich möchte.
Perceived	Using the e-learning system improves my	Die Verwendung des E-Learning verbessert

usefull-ness	learning performance.	meine Lernleistung.
	Using the e-learning system enhances my learning effectiveness.	Die Verwendung des E-Learning erhöht meine Lerneffektivität.
	Using the e-learning system gives me greater control over learning.	Durch den Einsatz des E-Learning habe ich mehr Kontrolle über das Lernen.
	I find the system to be useful in my learning.	Ich finde das System nützlich für mein Ler-nen.
Attitude to use	Using the system is a good idea	E-Learning zu nutzen, ist eine gute Idee.
	Using the system is a wise idea	E-Learning zu nutzen, ist eine kluge Idee.
	I Like the idea of using the system	Ich mag die Idee, E-Learning zu Nutzen.
	Using the system is unpleasant	E-Learning zu nutzen, ist unangenehm.
Intension to use	I will use the e-learning system on a regular basis in future.	Ich werde E-Learning in der Zukunft re-gelmäßig nutzen.
	I will frequently use the e-learning system in future.	Ich werde E-Learning in der Zukunft häufiger nutzen.
	I will strongly recommend others to use the e-learning system.	Ich werde anderen besonders empfehlen, das E-Learning zu nutzen.