The Students' Perceived Use, Ease of Use and Enjoyment of Educational Games at Home and at School

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Abstract

Relevant literature suggests that today's children possess digital skills and competences that set them apart from the previous generations. This may be due to their continuous exposure to ubiquitous media and digital games. Therefore, this research uses valid measures from the Technology Acceptance Model (TAM), Theory of Planned Behavior, and from the Unified Theory of Acceptance and Use of Technology (UTAUT) to investigate the primary school students' attitudes and normative pressures toward playing educational games, at home and at school. The study was carried out amongst year-3 students in a small European state. The findings reported that there were strong correlations between the students' attitudes and their intention to play the school's games. The respondents indicated that they considered the educational games as useful and relevant for their learning. However, the results have shown that there was no significant relationship between the perceived ease of gameplay and the children's enjoyment in engaging with the school's digital games. These findings are consistent with the extant academic literature on the digital natives. To the best of our knowledge, there is no other study in academia that has explored the technology acceptance of digital games in primary education. Therefore, this contribution opens future research avenues as this study can be replicated in other contexts.

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1. INTRODUCTION

A number of researchers have argued that young students may possess different traits that set them apart from their predecessors ([1], [2], [3]). Today's children exhibit different behaviors and skills than their parents, mostly because of their increased use of digital technologies. A new generation of students, referred to as digital natives ([3]), are increasingly using the Internet from a tender age. Other common terms that are synonymous with 'digital natives' include; Generation Y ([4], [5]), Generation Me ([6]), millennials ([7], [8]), or the 'Net generation' ([9]). Evidently, the digital technology has become an ubiquitous part of our lives, as we use computers, educational games, digital music players, educational cams, cell phones, and other interactive media ([3]). The digital natives have acquired skills and capabilities through their continuous exposure to media and gaming technologies, and have developed new ways of thinking, new cognitive capacities and learning styles ([3]). Therefore, education must fundamentally change to meet the needs of these young individuals [3]. The use of educational games that are intended to support the students' learning is a student-centered approach that has been proposed by Prensky in 2001, among others ([1], [2], [10]).

There are a number of theoretical frameworks that have been utilized to explore the students' engagement with technology in different contexts, including; the Theory of Reasoned Action ([11]), the Technology Acceptance Model ([12], [13]); the Theory of Planned Behavior ([14]) and the Unified Theory of Acceptance and Use of Technology ([15]. [16]), among others. Hence, this study has adapted the valid and reliable measures to explore the primary school students' perceptions and motivations toward educational games. This contribution sheds light on the grade three students' use, ease of use and enjoyment of educational games, both at home and at school. It also investigates whether these young individuals are influenced by their peers, parents, and / or teachers to engage in the schools' games. This contribution addresses a gap in

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academic knowledge as it examines when, where and why these young individuals are (or are not) immersed in educational technologies.

2. LITERATURE REVIEW AND THE FORMULATION OF HYPOTHESES

2.1 The Theory of Reasoned Action

The Theory of Reasoned Action (TRA) was developed by Martin Fishbein and Icek Ajzen in 1975. Their TRA model aims to explain the relationship between the attitudes and the behaviors of individuals. It implies that the individuals' intention and motivation to perform certain actions will precede their actual behaviors as the persons' intentions are determined by their behavioral attitudes and subjective norms ([11]). Hence, TRA includes four general concepts: behavioral attitudes, normative pressures (or the subjective norm), behavioral intention, and actual behavior. There are many academic studies that have relied on the TRAs' measures to explore the behavioral intention to use educational technology ([10], [17], [18]).

2.1.1 Behavioral Attitudes

The individuals' positive (or negative) attitudes anticipate their behavioral intention to use the technology ([19]). However, this relationship between attitudes and intentions may differ across different technologies ([20], [21]).

2.1.2 Normative Pressures (or the Subjective Norm)

Individuals may be influenced by the normative beliefs and the social pressures to perform or not to perform certain behaviors ([14]). The normative pressure or the subjective norm" is defined as "the person's perception that most people who are important to him/her think that s/he should or should not perform the behavior in question ([11]). The TRA model suggests that the normative pressure has a direct effect on the individuals' behavioral intention. For

instance, the students may experience social pressures or organizational pressures to use technology in class ([22]). The students' referents, including; their educators, classmates, parents, et cetera, will probably exert their pressure on them to use the innovative technologies at home, and at school. Thus, the students' social influences can affect their commitment toward understanding, explaining, and predicting usage and acceptance of educational technologies ([17], [23], [24]).

2.1.3 Behavioral Intention and Actual Usage

Ajzen and Fishbein (1975) posited that the behavioral intention is determined by the individual's personal attitude toward the behavior and by the normative pressures that are experienced by individuals. The behavioral intention to use technological innovations is an important factor that determines whether users will actually utilize the technologies ([20]). Many studies have explored the relationship between the behavioral intention and actual usage of technology in different contexts ([22], [25], [26], [27], [28]).

2.2 The Theory of Planned Behavior

Another theoretical framework, namely, the theory of planned behavior (TPB) was subsequently proposed by Icek Ajzen in 1991. He contended that different individuals may possess (or lack) the necessary skills to use particular technologies. Therefore, Ajzen has extended Fishbein and Ajzen's (1975) TRA by introducing behavioral control in his Theory of Planned Behavior (TPB). He contended that the users of technology may (or may not) have complete control over their behavior ([14]).

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2.2.1 Perceived Behavioral Control

According to the TPB, the individuals' perceived control is directly related to their behavioral intention. TPB suggests that the perceived control is an important antecedent of the individuals' intention to use technology. It reflects their internal and external constraints on behavior. For instance, users would not use the technology if they lack the required experience and skills in utilizing it [17]. Therefore, the educational practitioners should take into consideration the learners' dispositions and find ways to improve their self-efficacy, as they prepare them to use the schools' technologies ([29], [30]). In other words, the behavioral control is concerned with the extent to which individuals believe that they are capable to use technology, with their current level of skills ([17], [31]). Thus, the individuals' perceived behavioral control is related to technology acceptance and usage ([32]).

Notwithstanding, the users of technology may also depend on its functionality ([19]), as facilitating conditions, including the right infrastructural environment at school, the provision of training and development, the access to information or materials, as well as ongoing administrative support will enable them to apply technology to be more productive or efficient in their tasks ([10], [33]). Such facilitating conditions can have a positive effect on the individuals' attitudes toward technology and on their perceived behavioral control ([10], [33], [34].). Conversely, the schools' poor facilitating conditions, including; the lack of computers, inadequate technical support, et cetera were often cited as barriers to the individual users' technology acceptance ([35]).

2.3 The Technology Acceptance Model (TAM)

Relevant academic literature suggested that another theory, namely, the technology acceptance model (TAM) is rooted on the principles of the TRA and TPB ([10], [35]). TAM has received

empirical support in academia for being robust in predicting the users' technology adoption in various contexts, and with a variety of innovations ([10], [17]). TAM indicated that the individuals' behavioral intention to use technology would be determined by their attitude, which would in turn be conditioned by the usefulness and the ease of use of the information systems ([22]). The perceived usefulness and the perceived ease of use are the key determinants of the individuals' attitude toward computer use ([35]). Both were found to be significantly related to the teachers' attitude toward computers ([13], [22]).

2.3.1 Perceived Ease of Use

In 1989, Fred Davis defined perceived ease of use (PEoU) as the degree to which a person believes that using a particular system would be free of effort. The author explored the extent to which a person thinks that the technology is user-friendly and free of effort. Alternatively, individuals may find that the technology is difficult to understand and use. If they think that the technology is complex, tedious and / or time-consuming; it is very likely that they will reject the technology ([36]). As a result, they won't be productive and efficient when they use it as they feel uneasy, apprehensive, or fearful of using computers ([37]). Therefore, both the computer anxiety or the PEoU can have an impact on the adoption of innovative technologies. For this reason, the PEoU has a significant direct effect on the perceived usefulness (PU) of the technology ([12], [13]).

2.3.2 Perceived Usefulness

The "perceived usefulness" (PU) of the technology is; the degree to which a person believes that using a particular system would enhance his or her job performance ([12]). The PU has to do with the degree to which a person believes that the technology will help him or her to perform

a certain task in an efficient and productive manner. Hence, the PU construct is concerned with the expected overall impact of technology on the individual's job performance (in terms of process and outcome). The PU has a direct effect on the individuals' ATU, intention to use, and actual usage of the technology ([38]).

2.3.3 Attitude toward Usage

The behavioral intention is affected by the individuals' attitude toward usage, as well as by the direct and indirect effects of PU and PEoU ([10]). Both PU and PEoU jointly affect attitude ([10]). Nevertheless, individuals may not always have a positive attitude towards technologies, although they may still perceive them as useful (PU) or easy to use (PEoU). In fact, the ATU construct is not always a strong predictor of technology acceptance ([13]). The users' attitude towards the use of technology may not have a significant influence on their behavioral intention to use it ([39]). Several individuals engage with the technologies simply because they perceive them to be easy or free of effort, or because they have access to well-supported infrastructures ([15], [16], [21]). However, very often, individuals are obliged to use certain technologies for their work. A number of studies have investigated the respondents' self-reported computer usage as well as their future intentions usage, as they integrated computer applications (including; word processing, spreadsheet, database, multimedia / presentation and internet) into their work. For example, teachers as well as students may also use different educational software, including; games and simulations, in-class and at home ([38], [40]).

2.3.4 Extensions of TAM

The PEoU positively influences the PU ([12], [13]). In simple words, if the technology is easy to use the individuals can benefit from it. Therefore, PEoU is a precursor of the individuals'

technology acceptance. Conversely, the technology may help individuals to achieve a goal or increase their performance. Therefore, the individuals would perceive the usefulness of a technology. As a result, they may be willing to use the technology.

The behavioral intention is formed as a result of the individuals' conscious decision-making processes ([15]], as there are strong relationships between the PU and the behavior intention, and between behavior intention and actual usage. However, the PU and PEoU are worse predictors of actual usage than behavioral intention; with PEoU being significantly worse than behavioral intention ([42]). Moreover, TAM does not include subjective or objective measures of technology usage. Perhaps, TAM should be supplemented and extended by using the subjective norm and image ([16]). It can include variables that are related to both human and social change processes ([18]). Other authors remarked that TAM should explain the adoption of technology by introducing external variables that could possibly determine the chain of influence from the independent variables to the dependent variables, as it is the case for TPB's behavioral intention ([15], [16], [20]).

2.4 The Unified Theory of Acceptance and Use of Technology

Many researchers have adapted TAM's measures as they inserted other constructs in their empirical investigations. For instance, there are researchers who have integrated elements from TAM and TPB as they explored whether the 'performance expectancy', 'effort expectancy', 'social influence' and 'facilitating conditions' were antecedents for behavioral intention and use behavior ([15]). In the Unified Theory of Acceptance and Use of Technology (UTAUT), the performance expectancy (PE) described how the users believed that the technology will support them in their work. PE is the degree to which an individual believes that using the technology will help him or her to attain gains in job performance" ([15]). This construct is

very related to TAM's 'perceived usefulness' ([12]). The UTAUT's "effort expectancy" (EE) construct was drawn from TAM's 'perceived ease of use'. EE was defined as "the degree of ease associated with the use of the system" (p. 450). Moreover, the social influence (SI) construct is very related to subjective norm ([11]) that was used in the theory of reasoned action and / or in the theory of planned behavior. SI is "the degree to which an individual perceives that important others believe he or she should use the new system" ([15]). Whilst, the facilitating conditions (FC) is comparable with the TPB's 'perceived behavioral control' as it includes the structural features of the environment, such as training, support, and access to technology. FC is "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" ([15], [16]). According to the UTAUT; PE, EE and SI are direct antecedents of behavioral intentions. However, FC may be considered as a direct determinant for technology usage. Along with FC, the behavioral intention to use is the other direct determinant of use, as in the theory of planned behavior. The first three constructs were related to goal-oriented beliefs, whilst the facilitating conditions were considered as certainty beliefs, and were important requirements for the use of technology ([24]). UTAUT is a definitive model that has synthesized previous empirical models and has therefore provided a good foundation for future research. In fact, UTAUT accounted for 70 percent of the variance (adjusted R2) in usage intention. It also includes control variables such as; gender, age, experience and voluntariness of use ([15]). Other researchers have included perspectives from the motivation literature as they also suggested that there were moderating influences of experience, voluntariness, gender, and age [16]). These demographic variables were confirmed as integral features of UTAUT; as they can affect the relationship between the four main constructs and actual use.

Many studies have empirically validated the UTAUT model ([16]). They found that the students' performance expectancy and effort expectancy were positively and significantly

related to their behavioral intention ([15], [16] [17], [25]. Unsurprisingly, the participants' ease of use that is synonymous with effort expectancy as well as the perceived usefulness (that is related to performance expectancy) are some of the most important factors that can determine the users' behavioral intentions to use the technologies ([12], [41]).

Essentially, this study builds on TPD, TAM and UTAUT, as it tests the following hypotheses:

H1: The students' perceived ease of use of the educational games is positively related to their perceived enjoyment in playing them.

H2: The students' perceived usefulness of educational games is positively related to their perceived enjoyment through gameplay.

H3: The students' perceived ease of use of the educational games is an antecedent of perceived usefulness, as reported in the Technology Acceptance Model.

H4: The perceived usefulness, ease of use and enjoyment, as well as the normative pressures from parents, teachers and other students are the antecedents for the students' engagement with the educational games.

3. METHODOLOGY

3.1 Research Design

This exploratory study uses valid and reliable measures, that comprised eight items from TAM's perceived usefulness and perceived ease of use of the educational games; it includes four items that measured the users' perceived enjoyment; three items that explored the users' social influences, as well as three items that investigated the student's behavioral intention to use the technology at home and at school.

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3.2 Participants

A pilot study was carried out among 148 grade-3 students in a small EU state. The participants were between 8-9 years of age. There were 90 males (61%) and 58 female participants (39%) in this study.

3.3 Measures

The questions were presented in a child-friendly layout as the questionnaire was designed to be as clear, simple and straightforward as possible. The questionnaire was interesting and easy to read. Therefore, the questions were brief and concise. The researchers avoided the use of difficult, ambiguous language, jargon and technical terms. Hence, the questionnaire did not formulate questions with more than one meaning that could have been subject to different interpretations. The questionnaire's statements were adapted to the young students to ensure that they will be easily understood by them. To elicit responses, the questionnaire featured three-point, child-friendly, Likert scales that included colorful, smiley faces that enticed the students' participation in the survey.

3.4 Procedure

The class teachers were expected to provide support to all students to better understand the survey's questions, yet they were committed not to influence their responses in any way. The students were divided into groups of three or four, and they were supported during the data gathering process. The questionnaire was filled in by the students in 10-15 minutes time (under the supervision of the researcher).

4 RESULTS

4.1 Descriptive Statistics

Table 1 shows the descriptive statistics on the perceived usefulness, ease of use and enjoyment constructs. It also indicates whether the respondents were experiencing normative pressures from their peers, teachers and parents to play educational games, at home and at school. The scores suggest that the children had high levels of technological acceptance as well as high levels of enjoyment in their gameplay, at home and school; as the means were all above 2.

The findings suggest that the children played more games at home than they did at school (Wilcoxon, $z = -3.729$, $p < 0.05$) and they enjoyed the games more at home than at school (Wilcoxon, $z = 2.681$, $p < 0.05$). Students perceived the games they play at school were easy to play than the educational games at home (Wilcoxon, $z = -3.187$, $p = 0.001$). They considered the use of the educational games at school more useful (Wilcoxon, $z = -3.214$, $p = 0.001$) relevant (Wilcoxon, $z = -3.187$, $p = 0.008$) and learnt more from them (Wilcoxon, $z = -2.493$, $p = 0.013$) than playing educational games at home. There was no difference between the home and school games' in terms of fun (Wilcoxon, $z = -0.378$, $p = 0.705$), excitement (Wilcoxon, $z = -0.504$, $p = 0.614$), holding attention (Wilcoxon, $z = -0.338$, $p = 0.735$), generation of interest (Wilcoxon, $z = -0.632$, $p = 0.527$), enjoyable (Wilcoxon, $z = -2.681$, $p = 0.1$) and commitment to use (Wilcoxon, $z = -0.462$, $p = 0.181$). In addition, there was no difference in terms of the teacher's influence (Wilcoxon, $z = -1.807$, $p = 0.71$), or the parents' expectations (Wilcoxon, $z = -0.158$, $p = 0.29$) between playing educational games at home and at school. The young students indicated that they were willing to play (Wilcoxon, $z = -1.944$, $p = 0.041$) with the educational games at home, rather than at school. The results suggested that they will probably continue using them (Wilcoxon, $z = -1.818$, $p = 0.022$) as they enjoyed playing them and also find them useful and easy to use.

Table 1. Playing Educational games at Home and at School

Construct		Home		School		Wilcoxon	Sig.
		M	SD	M	SD	Z	*p*
Perceived Enjoyment	Play	3.03	1.37	2.15	1.13	-3.729	0.002
	Fun	2.900	0.3992	2.917	0.3814	-0.378	0.705
	Exciting	2.800	0.5142	2.833	0.4929	-0.504	0.614
	Interesting	2.750	0.5712	2.800	0.4801	-0.632	0.527
	Enjoyable	2.883	0.4155	2.883	0.4155	-2.681	0.007
Perceived Ease of Use	Easiness of gameplay	2.467	0.7241	2.817	0.5039	-3.187	0.001
	Understandable games	2.315	0.8215	2.563	1.105	-1.054	0.051
	Ease of use	2.308	1.105	2.111	0.905	-1.118	0.078
	Skilled	2.154	1.008	2.087	0.842	-0.954	0.091
Perceived Usefulness	Holds Attention	2.650	0.6331	2.617	0.6132	-0.338	0.735
	Learn	2.583	0.6455	2.817	0.4691	-2.493	0.013
	Useful	2.367	0.8227	2.783	0.5237	-3.214	0.001
	Relevant	2.411	0.9542	2.817	0.4825	-2.645	0.008
Normative Pressures	Teachers	2.317	0.8732	2.500	0.7011	-1.807	0.071
	Parents	2.750	0.6277	2.833	0.4572	-0.158	0.29
	Peers	2.211	1.308	2.401	1.285	-1.574	0.15

Behavioral Intention	Willingness to use	2.464	1.107	2.356	0.478	-1.944	0.041
	Probable usage	2.509	0.844	2.441	0.591	-1.818	0.022
	Committed to use	2.288	0.725	2.310	1.577	-0.462	0.181

4.2 Data Reduction

The Kaiser Meyer Olkin (KMO) measure of sampling adequacy was acceptable at 0.901. Bartlett's test of sphericity also revealed sufficient correlation in the dataset to run a principal component analysis (PCA) since $p < 0.001$. An exploratory factor analysis (EFA) has been chosen to obtain a factor solution from a much larger dataset. A pro-max rotation method was used to examine the component correlation matrix. The results suggested that the correlation between the components was important as it was more than 0.2, therefore the factor scores were retained. The values less than 0.4 were suppressed. EFA indicated that there were many variables that shared close similarities as there were highly significant correlations. There were patterns within the data that were expressed by highlighting relevant similarities (and differences) in each component. In the process, the data has been compressed as it was reduced 5 dimensions. Table 2 illustrates the amount of variance in the original variables (with their respective initial eigenvalues) for each component.

Table 2. Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1. Behavioral Intention	10.9	59.403	59.403	10.7	58.338	58.388	9.064
2. Perceived Usefulness	1.326	7.221	66.624	1.14	6.809	65.197	7.384
3. Normative Pressures	1.015	5.04	71.664	0.72	4.234	69.431	5.289
4. Perceived Enjoyment	0.895	4.881	76.545	0.68	3.448	72.879	6.348
5. Perceived Ease of Use	0.813	3.908	80.453	0.61	2.658	75.537	6.217

Extraction Method: Principal Axis Factoring.

With respect to the scale's reliability, all constructs were analyzed for internal consistency by using Cronbach's alpha. The composite reliability's coefficients were well above the minimum acceptance value of 0.7 ([43]). The extracted factors accounted for more than 80% variance. The factor components were labelled following a cross-examination of the variables with the higher loadings. Typically, the variables with the highest correlation scores had mostly contributed towards the make-up of the respective component. The underlying scope of combining the variables by using component analysis was to reduce the data and make it more adaptable for regression analysis.

4.2 Testing of the Hypotheses

The four hypothesized relationships were investigated by using the multivariate regression analysis. A stepwise procedure was chosen to select the most significant, predictive variables in the regression equations. Therefore, the *p*-value was set at less than the 0.05 benchmark. This also resulted in adequate F-ratios and the corresponding t-statistics; implying that only the significant amounts of variation in regression were accounted for. More importantly, in the stepwise procedure the insignificant variables were excluded without appreciably increasing the residual sum of squares. The regression models produced the regression coefficients that represented the strength and the significance of the relationships.

H1: There were no significant relationships between the students' perceived ease of use of the educational games and the perceived enjoyment from their gameplay, both at home and at school. The results for the first hypothesis were inconclusive.

H2: The students enjoyed playing the educational games as they held perceived them as useful at home (where adj. $r^2 = 0.406$, t = 1.323), and at school (where adj. $r^2 = 0.28$, t = 3.874). These results were highly significant, as $p < 0.01$.

H3: The students' perceived ease of use of the educational games was positively and significantly related to the perceived usefulness of the game; where the adj. $r^2 = 0.368$, t = 2.865, and $p < 0.05$.

H4: The perceived use and enjoyment were positive and significant antecedents for the students' behavioral intention to engage with the educational games. There was an adj. r^2 =0.264 and t = 0.842 between PU and BIU, and an adj. r^2 of 0.411, where t = 1.105 between PE and BIU. In both cases, $p < 0.05$. However, the findings suggested that perceived ease of use and the normative pressures were not significant antecedents for the students' behavioral intention to play the educational game.

5 CONCLUSIONS

This contribution has explored the primary school's grade three students' attitudes toward educational games. It relied on the technology acceptance model to investigate the students' perceived usefulness and ease of use of the schools' games ([10], [12], [44]). Moreover, the researchers have also included the measuring items that explored the students' perceived enjoyment ([19]) as they investigated whether they experienced normative pressures to play the educational games ([10], [14], [20]). The findings from the Wilcoxon test reported that the students played the school games at home, more than they did at school. They indicated that the school's games were easy to play. This study reported that the students recognized that the

school's games were useful and relevant as they were learning from them. Moreover, they indicated that the school's educational games held their attention since they found them enjoyable and fun.

The vast majority of the children played the educational games, both at home and at school. The findings in this study are consistent with the argument that digital natives are increasingly immersing themselves in digital technologies ([45]), including educational games ([1], [3]). However, the results have shown that there was no significant relationship between the perceived ease of the gameplay and the children's enjoyment in them. Furthermore, the stepwise regression analysis revealed that there was no significant relationship between the normative expectations and the children's engagement with the educational games; although it was evident (from the descriptive statistics) that the parents were encouraging their children to play the games at home and at school.

This research relied on previously tried and tested measures that were drawn from the educational technology literature in order to explore the hypothesized relationships. There is common tendency in academic literature to treat the validity and reliability of quantitative measures from highly cited empirical papers as given. In this case, the survey items in this study were designed and adapted for the primary school children who were in grade 3, in a small European state. Future studies may use different sampling frames, research designs and methodologies to explore this topic.

To the best of our knowledge, there is no other empirical study that has validated the technology acceptance model within a primary school setting. Further work is needed to replicate the findings of this research in a similar context.

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