Attitudes Towards Mobile Devices in Estonian Basic Education: Using the Framework of the UTAUT Model

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Abstract. Despite the use of mobile devices becoming more ubiquitous, and the possibilities they offer for learning becoming more recognized, research shows that mobile devices are not always used to their fullest potential. Previous studies have found that attitudes towards technology can influence whether, and in what way, mobile devices are used. At present, there have been few studies focusing on samples of basic school students and mobile device use. It was our aim, therefore, to test whether the widely used theoretical UTAUT model could also be applied to a sample of basic school students, or whether some changes would be required before it could be used for a study of attitudes towards mobile devices among basic education students. 3521 Estonian basic school students from 6th (n = 2673) and 9th (n = 848) grades participated in the study. From the results 4 attitude factors could be distinguished. These included: Self-efficacy, Social Influence, Anxiety and Performance Enjoyment. The attitudes towards mobile devices in learning explained approximately 43% of the variance of student's Behavioural Intention to use mobile devices, while Performance Enjoyment played a mediating role on the influence of Self-efficacy. Behavioural Intention explained 2% of the variance in the use of mobile devices for learning. The results suggest that some changes should be considered when researching students' attitudes towards mobile devices in basic education.

Keywords: UTAUT · Primary education · Students · Mobile devices · Attitudes

1 Introduction

Over the last two decades the accessibility and the use of technology has grown considerably, with things like information and communication technology (ICT), mobile devices becoming commonplace. This trend is evident in everyday life, as well as in learning environments. Teachers and educators are now encouraged to use mobile devices in educational settings. However, not all students take full advantage of the possibilities that mobile devices, such as smart phones and tablets, offer. There is a general concern as to how students will use these mobile devices and whether they will be used for educational purposes or simply for gaming. Several studies show that attitudes towards technology, such as ICT, can have an impact on whether the devices are used in an educational setting and how they are used [1, 2]. The DIGCOMP

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(A Framework for Developing and Understanding Digital Competence in Europe) framework has also assisted in highlighting certain attitudes that are an important part of digital competencies [3]. It is therefore, necessary to examine the attitudes of students themselves towards mobile devices, as this can be instrumental in gaining an understanding of how mobile devices are actually used for learning. Furthermore, attitudes can give information on how to better develop interventions in order to help students use their mobile devices to their fullest potential. However, at present there has been a dearth of studies investigating students' attitudes and their relationships with mobile devices in a learning context. This is due to the fact that the vast majority of the existing research has only studied attitudes towards computers, such as ICT, and generally not focused on basic education [4, 5]. Portable devices, such as tablets and smart phones allow for more flexible possibilities in educational settings, as they can be used to support learning related activities more easily during the usual classes, and teachers no longer need to take students to a computer lab. Thus, mobile devices create new possibilities. Nevertheless, questions still arise as to the usefulness and usability of these devices. Therefore, it is important to test the existing theories and models that explain the relationship between attitudes towards the use of mobile devices within an educational context.

1.1 Measures of Attitude

There are several theoretical frameworks that allow researchers to measure the attitudes of people towards technology. Some of the most common of these include the technology acceptance model (TAM), the theory of planned behaviour (TPB), and the Unified Theory of Acceptance and Use of Technology (UTAUT) [2]. These models have proven useful for explaining the use of technology [6]. The UTAUT has become one of the most popular as it combines eight models and theories (e.g. TAM, TPB) in order to explain the factors that influence the acceptance of technology. Based on some of these pre existing theories, the authors utilized 7 attitudinal factors that have a direct influence on people's willingness to use technology, or as we term it Behavioural Intention, in different fields. They are as follows:

- Performance Expectancy – the degree to which an individual believes that using the technological system will help him or her to do a task more effectively;
- Effort Expectancy – the degree of ease or difficulty associated with the use of technology;
- Attitude Towards Technology Use/Enjoyment (ATUT) – the degree to which an individual experiences positive feelings (e.g. interest, enjoyment) towards the use of technology;
- Social Influence – the degree to which an individual perceives that it is important to others that he or she should use technology,
- Facilitating Conditions – the degree to which an individual believes that there is organizational infrastructure to support the use of technology;
- Self-efficacy – the belief in an individual's capability to successfully cope with using technology;

- Anxiety – the degree to which an individual experiences negative feelings (e.g. fear, doubt) about using technology.

The authors found that only Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions actually had a direct influence on the intention to use, and the actual use of a certain technology (such as a computer or a specific program). Later research shows that all 6 categories in addition to Behavioural Intention (with the exception of Anxiety) could be differentiated in cross-cultural studies [7]. Furthermore, researchers have taken into account several variables that were not included in the original work of Venkatesh and colleagues in order to adapt the model into a different context (e.g. higher education [8]; computer based assessment [9]). The UTAUT is based on research made using ICT examples, and examines attitudes towards computers and other technological devices, but does not focus on mobile devices. However, in later studies, researchers adapted the theory and model to incorporate a more diverse array of technological applications in which case several additional variables were added, thereby demonstrating the effect on Behavioural Intention [10]. Based on this development, Venkatesh went back to the original model and made some modifications by adding the factors of Hedonic Motivation, Price Value and Habit (UTAUT2) [11]. The original model explained 77% of the variance in Behavioural Intention and 52% of the actual use of technology, while the percentages for the UTAUT2 were 74% and 52% respectively [10]. Based on previous results it is apparent that the addition of the three aforementioned variables does not affect how much of the dependent variable is explained. Despite criticism of the model in connection to whether the list of predictive variables is comprehensive enough, and conversely, whether there may be too many variables to make conclusions, as well as the question concerning the connection between Behavioural Intention and actual behaviour [12], the UTAUT is still a widely used model that has been validated by several empirical [10]. However, there is still a need to critically test the theory in new contexts.

Research using the UTAUT model shows it to be a useful framework for discerning attitudes towards technology. However, further research has also demonstrated the need for more flexibility in connection to the variables under observation. This is due to the fact that, depending on the context, other disparate attitudes can have a significant influence on the potential use of technology. As research on the use of mobile devices at the basic education level has been scarce, it raises the question of whether the UTAUT model can in fact be applied to the aforementioned context?

1.2 Attitudes Towards Technology in Educational Setting

The application of the UTAUT in an educational environment has been rather uncommon up to this point [10]. The vast majority of studies using the UTAUT have focused on organizations and work conditions, with few studies being conducted in educational settings. The studies that have focused on educational settings took place in universities [10]. This is somewhat surprising given the fact that the PISA results show that more and more basic school students have access to, and make use of technology

in their everyday life [13]. The increasing importance of examining the factors that influence the attitudes towards technology, and the necessity of analysing of what technology is being used for among basic school students cannot be overstated. Experiences that are imprinted on students of that age can have impact on how they use their mobile devices later in life. Although the UTAUT has not been widely applied to this context, there are many independent studies showing that students' attitudes towards technology in learning plays an important role in peoples' willingness to use digital devices and whether the devices are in fact used for learning. Some examples of this will be given later.

In Terzis' and Economides's [9] study of university students' attitudes towards computer based assessment (CBA), they found that Perceived Ease of Use had a direct effect on behavioural intentions to use CBA's, whereas Self-efficacy had an indirect effect. Self-efficacy, or more specifically Computer Self-efficacy, has received a lot of attention in the field of technology acceptance and has been shown to play an important role in understanding how technology is used [14]. In the context of mobile learning (learning with mobile devices) among university students, it has been shown that Performance Expectancy, Effort Expectancy, Influence of Lecturers, Quality of Service, and Personal Innovativeness have a positive effect on behavioural intention [8]. It is also necessary to point out that in a university learning context, the Quality of Service, and Personal Innovativeness could be possible additions to the UTAUT model. [15] have also done research on the acceptance of tablets in an educational setting among university students. Using the UTAUT model they found that Effort and Performance Expectancy had a positive influence on Behavioural Intention through a more general positive attitude towards tablets. Social Influence and Facilitating conditions, on the other hand, had a direct positive effect on Behavioural Intention. But because past studies have focused on the university setting, it is difficult to say whether similar results could be expected from a sample of basic school students. Although, there has been research on basic school students indicating that attitudes towards ICT can determine whether technology is used for learning or not [16], this study was more descriptive in nature, and left many questions unanswered as far as the role of basic school students' attitudes towards the use of technology.

1.3 The Present Study

The aim of our study was to test whether the theoretical model of the UTAUT could be applied to the sample of basic school students, or whether some changes would be necessary before it could be used to research attitudes towards mobile devices in basic education.

We formulated the following research questions:

1. Can the factors of Performance Expectancy, Effort Expectancy, Enjoyment, Social Influence, and Anxiety of the UTAUT model be differentiated in the Estonian basic school student sample?
2. Which of the variables (Performance Expectancy, Effort Expectancy, Enjoyment, Social Influence, and Anxiety) predict students' Behavioural Intention, and can they be used to predict the use of mobile devices for learning?

2 Methods

2.1 Participants

In the spring of 2016 we conducted a large-scale study focusing on the use of mobile devices in an educational context among Estonian students. The study questioned 3521 students in the 6th (n = 2673) and 9th (n = 848) grades, from 147 schools with an average age of 13.3 (6th grade M = 12.6 and 9th M = 15.6). In total, 1824 girls and 1697 boys participated. Several criteria were used to select the schools from which the sample group was drawn. These criteria were: general education (the sample group did not include schools with special education); the use of Estonian as the basic teaching language; having more than 5 students in the target classes (6th and 9th), and a specific region (proportionally students from the city, the country side, bigger and smaller schools, etc.).

Parental consent in written form was gained before the questionnaires could be administered to the students. Only students' whose parents had agreed to the survey were requested to fill out a questionnaire. The questionnaires were administered in school, during class, using computers or tablets. The survey took approximately 45 min to fill out.

97% of the students who participated in the study reported owning a mobile device that could be used for learning. However, most of them primarily used their mobile devices for purposes other than learning. Our previous analysis of the same data showed that 49.9% of the students used their mobile devices for learning once a month or even less and only 4.9% of students use it for different learning tasks on a daily basis, such as for information searches, communication, and content creation [17]. However, 74.2% of students stated that they would be willing to use their mobile devices for learning, and only 9.3% of the students reported that they would be opposed to it.

2.2 The Instruments

Attitudes towards using mobile device for learning. The UTAUT was used as the theoretical basis to measure the student attitudes towards the use of mobile devices for learning. As mentioned in the introduction, the theory and the model have not been previously used in such a context, therefore we used a previously validated and reliable questionnaire to ask students about their attitude towards mobile devices in learning. However, as the previously mentioned the questionnaire did have some shortcomings (it did not have items regarding self-efficacy etc.). For this reason some constructs based on UTAUT were added.

The mobile device attitude questionnaire that we developed was based on a pre-existing questionnaire that had been developed by Pruet and colleagues [18]. It consisted of 20 items. Based on the theoretical background some additional items were added in order to measure Social Influence, Self-efficacy and Effort Expectancy [2]. The final questionnaire consisted of 31 items that were adapted into the Estonian

language and a mobile device context. In addition, students reported on their willingness to use mobile devices for learning in STEM subjects (5-point scale).

Behavioural Intention and the use of mobile devices. Behavioural Intention to use mobile devices was measured via one item (with a 5-point scale): "I am willing to use mobile devices for learning".

Students answered questions related to how often they use mobile devices for information searches, communication, content creation and gaming in connection to learning; while they were in school; while they were outside of school, and how often they used mobile devices outside of school for other purposes. The activities were then grouped according to the nature and the location of the activity – in school for learning, outside of school for learning and outside of school for other purposes. The primary focus of the present study was on mobile device activities with a direct educational purpose.

2.3 Data Analysis

The statistical program Mplus (Version 7; [19]) was used for Confirmatory Factor Analysis and Structural Equation Modeling. In order to evaluate the models we used criteria for fit indexes proposed by Bowen and Guo [20], which are as follows: RMSEA: close fit: $\leq$ .05, reasonable fit: .05–.08, poor fit: $\geq$ .10; CFI: $\leq$ .95; TLI: $\leq$ .95.

3 Results

3.1 Attitude Factors for Students

Based on the confirmatory factor analysis (CFA) results, it was possible to discern 4 attitude factors from the student sample: Self-efficacy, Social Influence, Anxiety and Performance enjoyment ($\chi 2(143) = 1842.77$, $p < .01$, RMSEA = .058, CFI = 0.95, TLI = 0.94). The factor model is shown in Fig. 1. The Performance Enjoyment factor was formed by combining the Performance Expectancy and the Enjoyment factors. As seen in the Fig. 1 there was rather strong positive correlation between the Self-efficacy and the Performance Enjoyment factors ($r = .79$, $p < .01$) and a negative correlation between the Self-efficacy and the Anxiety factors ($r = -.64$, $p < .01$). One Effort Expectancy item (Eff2; "It is difficult to use mobile devices for learning") loaded onto the Anxiety factor, while another Effort Expectancy item (Eff1; "Using mobile devices for learning makes learning easier") loaded onto the Performance Enjoyment factor. Both of the items fit the description of the new factors and the changes were therefore acceptable. The model with Social Support and Effort Expectancy factors did not give satisfactory results ($\chi 2(174) = 3968.58$, $p < .01$, RMSEA = .08, CFI = 0.90, TLI = 0.88).

3.2 Attitudes as Predictors of Behavioural Intention and the Use of Mobile Devices

Attitudes towards mobile devices in learning explained approximately 43% of the variance for the Behavioural Intention of students (Fig. 2). Behavioural Intention in turn explained 2% of the variance for the use in school and 2% of the use of mobile devices for learning at home respectively. Self-efficacy had an effect on Behavioural Intention through the mediation of Performance Enjoyment, with the former explaining 61% of the latter.

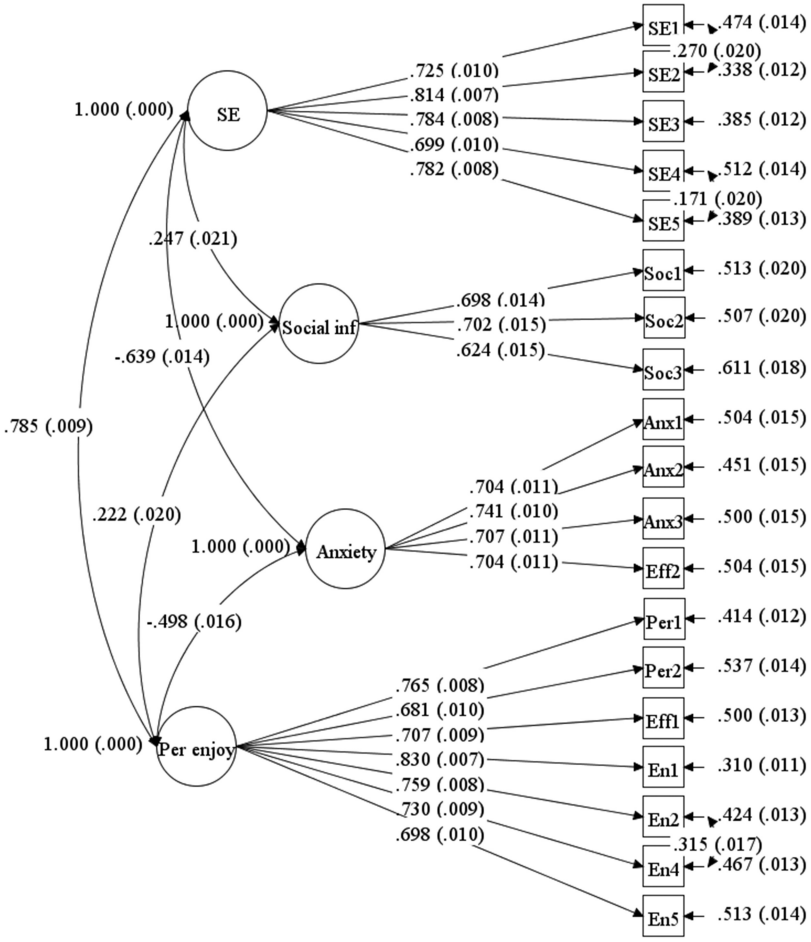

Fig. 1. The model of confirmatory factor analysis: students' attitudes towards using mobile devices for learning; standardized solution. All regression coefficients and correlations are significant at the level $p < .01$ (standard errors brought in parenthesis). SE – Self-efficacy; Social inf – Social Influence; Per enjoy – Performance enjoyment

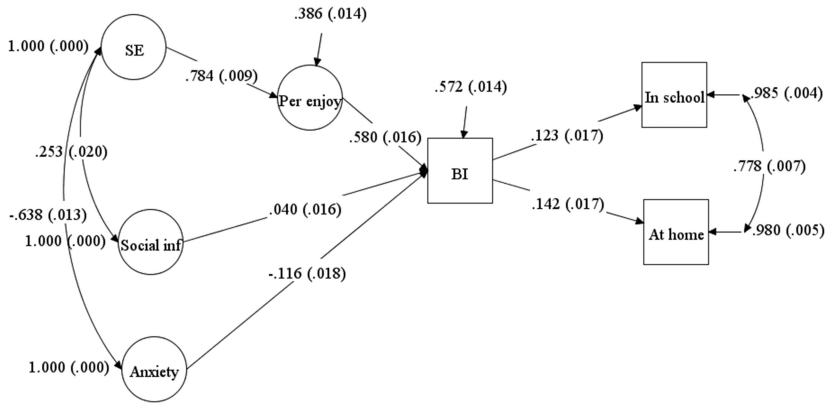

Fig. 2. The model prediction of students' Behavioural Intention (BI) and mobile device use in school and outside of school for learning (At home) via attitudes towards mobile devices (Self-efficacy (SE), Social Influence (Social inf), Anxiety and Performance enjoyment (Per enjoy)). Standardized Solution; N = 3527. All regression coefficients are significant at the level $p < .01$; $\chi 2(199) = 2753.61$, $p < .01$, RMSEA = .06, CFI = 0.94, TLI = 0.93).

4 Discussion

Several studies show that attitudes towards technology, such as ICT, can have an impact on whether, and in what way various digital devices are used [1, 2]. Extensive research using the UTAUT model has shown that it is applicable to a wide range of samples [10]. However, at present there have been few studies investigating the attitudes of basic school students and their use of mobile devices for learning. This is due to the fact that the vast majority of the existing research has made use of general ICT examples, without applying it to an educational context [4, 10]. The aim of our study was to test whether the theoretical model of the UTAUT also applied to mobile device use of the sample of basic school students.

The results of the confirmatory factor analysis showed that there were 4 attitude factors that could be detected from the student sample: Self-efficacy, Social Influence, Anxiety, and Performance Enjoyment. The last attitude factor was a composite of the Performance Expectancy and Enjoyment of Use factors. The results were somewhat surprising in light of the previous work that has been done using the UTAUT. Although there has been significant correlation between Performance Expectancy and Enjoyment (or Attitude Towards the Use of Technology), the correlation itself has been weak to moderate [2, 11]. This may however suggest that basic education students make no distinction between usefulness and enjoyment, and therefore in order for students to perceive an application as being useful, they must also find it to be enjoyable.

Students' attitudes towards mobile devices explained almost 43% of the variance in the Behavioural Intention of students use of mobile devices in learning. Whereas

Self-efficacy had an indirect effect on the Behavioural Intention through Performance enjoyment, with the former explaining 61% of the latter. These findings are in alignment with previous research showing that Self-efficacy has an indirect influence on Behavioural Intention [9]. Terzi and colleague however did not investigate the relationship between Self-efficacy and Performance Expectancy, although they were able to demonstrate a similar relationship with the mediation of Perceived Effort of Use [9]. The similar role of Self-efficacy has also been brought out in the Technology Acceptance Model [21], In that model Self-efficacy had an indirect influence on Behavioural Intention as well. The results from present study give us reason to believe that students who feel more confident using mobile devices may also find the activity to be enjoyable and useful. This in turn facilitates the use of mobile devices for learning and may help motivate students to use mobile devices for educational purposes. Furthermore, future studies should consider other possible mediating variables when investigating the influence of Self-efficacy on Behavioural Intention.

Behavioural intention explained 2% of the variance of the use of mobile devices for learning in school, and 2% of the use of mobile devices for learning outside of school respectively. This is much lower than the rates that have been found in previous studies (e.g. [10]). The results show that even if students have positive attitudes towards, and a willingness to use, mobile devices for learning, the behaviour may not actually become manifest. It could be that some characteristics which may be specific to a basic school context, and which we have not focused on in this study, also have an influence on students' behaviour. For example, several studies show that a teachers' own attitudes have an important influence on whether they are willing to use technology in teaching [22, 23]. Therefore, a teachers' own attitudes towards mobile devices and the willingness to use them may be one of the factors that influences the behaviour of students in basic school when it comes to the use of technology for learning. On the other hand, previous research has also brought to light similar results that show a weak relationship between BI and behaviour [24]. It is the relationship between these factors in the UTAUT model that has received the strongest critique [12]. As Bagozzi has mentioned, the singular link between Behavioural Intention and behaviour itself discounts the other possible factors that may influence whether individuals acts on their intentions [10]. The results from the present study also indicate that Behavioural Intention may be insufficient for predicting the usage of mobile devices for learning.

4.1 Limitations and Future Studies

Our sample was representative of the Estonian educational context, however, the proportion of 6th and 9th grade students was somewhat uneven, which may have had an influence on the applicability of the results among the two age groups. Therefore, the latter would be an important variable to take into account in future studies, especially when comparing the results for 6th and 9th grade students.

Future studies should also take into account teacher level variables, which may have a significant influence on students' behaviour when it comes to mobile device use for educational purposes. At present the UTAUT models have mostly been applied to adult samples where participants have more autonomy over their behaviour (than for example

basic education students). This may be an important factor to take into account in future studies. It should also be mentioned that information on the students' behaviour was gathered through self-report questionnaires, which may be biased due to social-desirability. For this reason, the results of the questionnaires may not reflect the actual objective frequency of smart device use for learning by students. Future research should also make use of objective data on students mobile device use whenever possible.

Finally, it is important to consider the possible influence of the cultural context. Previous research has shown that the predictive power of the UTAUT model may vary across cultures [15]. More specifically, the research was done in the Estonian context, where it is very common for students to either have mobile devices at school, or for students to have the possibility of using their own mobile devices at school. Previous research does not provide direct information about how often mobile devices are actually used for learning, but rather has focused on mobile device availability. The habits of mobile device use may not apply to all cultures and should be taken into account when generalizing the results.

Future studies should also consider using the theoretical background of the renewed UTAUT models, and adding, for example, the additional factor of Habit to the list of predictive variables [11]. As was mentioned before in the discussion, the results are also in alignment with the TAM theoretical model, which gives us reason to believe that future studies may benefit from either combining several models together, or from developing an altogether different model that would suit the basic school context.

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