A first step towards a model for teachers’ adoption of ICT pedagogy in schools

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Abstract

It is important to identify and understand important factors underpinning the integration of information and communication technology (ICT) in schools. And, it is important that ICT is adopted in a sound pedagogical manner. The aim with this study was to suggest a model for the actual use of ICT in schools and how it may be related to important factors such as technological pedagogical expectations. The design of the model was inspired by TAM2 and UTAUT models, but with some modifications. We have developed a model which highlight the pedagogical aspects beyond the technical ones. Furthermore, our suggested model also include the adoption of digital techniques in everyday life as a potential predictor of adoption of ICT at work. The sample consists of 122 teachers and we analyzed the model with a structural equation model. This study contributes with a suggested model including a new construct for measuring expected performance from a technological pedagogical point of view. This new construct was a significant predictor to actual use of ICT in school. Furthermore we also developed a new construct for adoption of ICT in everyday life, which also was a significant predictor to actual use of ICT in school.

Keywords: Information science, Education
1. Introduction

From an optimistic point of view, information and communication technology (ICT) has the potential to improve learning and teaching methods. The possible merits include, for instance, more creative learning environments, support of student-centered self-directed learning, and collaboration independent of place and time (Fu, 2013). Even though ICT shows this potential, the implementation of ICT in schools seems to develop slowly, and it has been reported that teachers use ICT infrequently and more for information transmission rather than the promising benefits mentioned above (Chai et al., 2011). Some of the barriers to more holistic implementation identified are lack of access, resistance to change, lack of time, and lack of training and support (Bingimlas, 2009). Lack of training includes both technical training and pedagogical approaches. Naturally, ICT doesn’t improve learning per se, and will not make any difference simply by being used (Higgins, 2003). There is a need for technological pedagogical competence, in order to find sound ways of integrating ICT and refined teaching methods. A conceptual model describing competencies needed for teachers of today is the TPACK model (Mishra and Koehler, 2006), which includes three dimensions: technological knowledge, pedagogical knowledge and content knowledge. This model is important on a conceptual level, pointing out the need for competence in how to integrate the different types of knowledge. The model, however, has been criticized for not being practically useful, and studies vary significantly in how TPACK is being operationalized (Willermark, 2017), making further development of instruments highly desirable.

With its roots in theory of reasoned action (Ajzen and Fishbein, 1980) a model for technology acceptance have been established within information systems (IS) research. The use of survey instruments based on the core concepts of Technology Acceptance Model (TAM) has gained tremendous popularity over the last two decades. TAM is reportedly one of the most widely used theory-based and empirically tested models to explain and predict user acceptance of new information technology (Yousafzai et al., 2007) which is also shown to predict user’s actual system use when testing it using both subjective and objective measures (Turner et al., 2010) of such a construct. The TAM model has also been criticized for being too technologically deterministic and for neglecting important factors like culture and social interactions (Bagozzi, 2007). The model has been further refined into the TAM2 model (Venkatesh and Davis, 2000) and the comprehensive unified theory for acceptance and use of technology (UTAUT) (Venkatesh et al., 2003), see Fig. 1. These different models are widely used in research and consequently, because of their popularity, a considerable number of questionnaires have been built on the fundamental ideas underpinning this model.

There is, to our knowledge however, no existing measurement model specifically developed for studying ICT in schools. There are several studies of the use of ICT in schools based on the TAM model, but these focus more on the technical
aspects and the use of technology generally and are not from a technological pedagogical point of view. We believe that such a measurement model could help us understand and identify important factors underpinning the integration of ICT in a sound pedagogical manner. Such a measurement model could also constitute a practical tool for schools striving to increase this competence.

The aim with this study was to suggest a model for the use of ICT and technological pedagogical adoption in schools. A measure for “usefulness” including technological pedagogical aspects was developed as a part of this model. The model also included a new measure focusing on the adoption of ICT in everyday life. A number of hypothetical relationship were tested using the generated model.

2. Model

Our model was inspired by the UTAUT model mentioned above, but we have further developed the different factors in order to increase the relevance for technological pedagogical adoption. Details regarding the different factors and corresponding items are given in the method section below.

Beyond the factors found in the UTAUT model we have also expanded the model with a new factor called “Digital Living.” This factor assesses to what degree an individual has adopted ICT in everyday life, e.g. for organization, socialization, learning and pleasure. A reasonable thought is that a person who, to a high degree, is using the benefits of digitization in everyday life, has higher propensity to also see the potential benefits with ICT in work and may also find the use of ICT easier than a less “digitized” person. Details are given in the method section.

The hypothesized relationship between the factors described above is similar to the relationships found in the UTAUT model, but with “Digital Living” added, as visualized in Fig. 2 (moderating factors: gender, age, experience and voluntariness excluded).
Our hypotheses were:

i. Digital living is positively correlated to performance expectancy
ii. Digital living is positively correlated to effort expectancy
iii. Performance expectancy is positively correlated to actual use
iv. Effort expectancy is positively correlated to actual use
v. Social influence is positively correlated to actual use
vi. Facilitation is positively correlated to actual use

3. Method

The TAM, TAM2 and UTAUT models have been used for identifying suitable items. But, in order to adjust our model to a school context, a number of new items were suggested. Furthermore, we also suggested a completely new construct: “digital living.” The research group generated a large pool of potential items. All items were discussed with a project group at a school interested in taking part in this survey and the school specialist in technological pedagogical issues. Furthermore, the new construct of digital living and corresponding items were tested in a group of five specialists within information systems and pedagogy. After refining items, the whole questionnaire was tested in a pilot study including 40 teachers at a local school. These 40 answers were analyzed in an explorative manner and the results and experiences from this pilot study were used for further refinement leading to the final version of the questionnaire. Many of the items include the abbreviation “ICT,” defined broadly in the questionnaire to include both technical devices (e.g. tablets and smartphones) and tools (software, systems, Internet, etc.).

3.1. Material

A total of 159 teachers in elementary school (age 6—16) were invited to a conference and at the same time (April 2017) invited to take part in this survey. The survey was administrated online by using Survey Monkey. Participation was voluntarily and
anonymous. According to Swedish regulations no ethical approval was required for this study. Ethical issues were discussed with vice-chancellors and management for participating schools who gave the approval for the study. A total of 122 responded to the questionnaire (77%). There were however 19 responders who only responded to a small part of the survey and omitted the majority, e.g. all questions concerning “actual use” were unanswered. These 19 individuals were probably teachers who were presently in another position, e.g. administrator, and therefore couldn’t respond to questions concerning everyday teaching. These 19 individuals were excluded completely from the analysis. Among the remaining 103 responders, missing values were assumed to be due to random factors and we used two different strategies for imputation. First, missing values were imputed within factor, by using the distribution among the responded items within that factor. Second, we used imputation by full information maximum likelihood (FIML) (Graham and Coffman, 2012). The final model was analyzed with both imputation approaches showing similar results. The reported results are based on the FIML approach.

3.2. Analysis

Basic demographics for the sample are based on standard descriptive statistics. Confirmative factor analysis was used for studying the measurement model. Modification indices were used for identifying potential correlations between errors (within the same factor) and were used for re-specification of the model. Factor loadings were scrutinized and items with loadings less than 0.6 were excluded and the model was re-estimated. Thus, CFA was used in a model-generating fashion. Reliability and validity were studied by using composite reliability (CR) and average variance extracted (AVE). A CR > 0.7 was regarded as adequate reliability and an AVE > 0.5 indicates convergent validity. For discriminant validity the square root of AVE should be greater than all inter-factor correlations (Hair et al., 1998; Fornell and Larcker, 1981). For assessing goodness-of-fit of the full model, Cmin/df, CFI and RMSEA were used and interpreted as follows: Cmin/df < 3 (good fit), CFI > 0.90 (good fit), RMESA < 0.05 (good fit) RMSE 0.05−0.10 (moderate fit) (Hu and Bentler, 1999).

3.3. Instrumentation

All the factors in the model (excluding the endogenous variable “Actual Use”) visualized in Fig. 2 were analyzed with confirmatory factor analyses (using AMOS 23.0 IBM SPSS ®). In order to keep the number of items reasonable, only items with loadings greater than 0.6 were kept in the final model. We will now discuss all the factors, one by one, starting with:

Digital living: This completely new factor was intended to measure an individual’s adoption of ICT in everyday life, e.g. for organization, socialization, learning and
pleasure. Our intention was that this factor should measure if a person uses and appreciates the opportunities offered by the digitized society, if the person is “digitized.” This factor includes 15 items and all items were included in the pilot study, the sample (our 103 responses) and in another ongoing research project regarding knowledge sharing (265 responders). Explorative factor analysis suggests that these 15 items measure one or two components and we identified three items that consistently seemed to measure a component other than the intended. We believe that these three items measure if an individual finds an intrinsic value in digital technology, i.e., that an individual likes the technology in itself, no matter the potential usefulness. These three items were excluded from the confirmatory factor analysis (CFA), since this kind of “nerdiness” was not intended to be included in our construct. Thus 12 items were included in the CFA, of which eight turned out to have loadings greater than 0.6 (shown in bold in Table 1). Modification indices identified two correlations between pairs of errors. We believe that this is due to content overlap, and correlations were kept in the final model.

Performance expectancy (PE) could generally be described as: “The degree to which an individual believes that using the system will help him or her to attain gains in job performance.” The generic items include statements like “useful in my job,” questions about efficiency and productivity, and also the chance of getting a raise by using the system. We added two items concerning preparing and conducting teaching,

Table 1. Digital living items. The items included in the final model in bold, items in italics were excluded from CFA. The remaining items were included in the CFA but excluded due to a loading <0.6. Items with (a) have correlated error and items with (b) have correlated errors.

| Item                                                                 | Description                                                                 |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Digital technology is an important part of my social life (a).      |                                                                             |
| I get tremendous benefit from using my smartphone in everyday life (a). |                                                                             |
| I often use digital technology as an advisor or guide to accomplish various tasks in everyday life, such as cooking, carpentry, etc. (b). | |
| I would say that digital technology actually helps me a lot in my everyday life (b). | |
| You could say that I am addicted to having my smartphone with me.    |                                                                             |
| When I travel, I would like to have access to the Internet.          |                                                                             |
| I also like to use digital technology as pastime, to play, surf, etc. |                                                                             |
| You could say that ICT is an important part of my life.              |                                                                             |
| I often use digital technology to acquire new knowledge.             |                                                                             |
| Digital technology helps me organize my everyday life.               |                                                                             |
| Digital technology can help me a lot in the practicalities of everyday life. | |
| Shopping online makes my everyday life much easier.                 |                                                                             |
| I belong to those competent users who tend to be the first to embrace new digital technologies. | |
| For me it is important to keep up with the digital developments.     |                                                                             |
| I’m always curious about the new digital technology.                 |                                                                             |
just to put job performance into an educational setting. We believe however that these items altogether only cover a part of PE in a school setting. We believe that these items focus on efficiency and productivity gains when conducting existing work tasks, i.e., that ICT replaces other, more tedious work processes. We were, however, interested in the expectancies regarding changes in work tasks, e.g. if ICT enables other ways of working and allows new pedagogical strategies that were impossible or more difficult to implement without the technology, i.e., the intersection between technological and pedagogical knowledge illustrated in the TPACK model. This includes, for instance, collaboration, new teaching methods, self-directed learning and collegial knowledge and expertise sharing, i.e., work-integrated learning (Gellerstedt et al., 2015). Thus, in line with the aim of the study, we wanted to expand performance expectancy to also include a technological pedagogical (TP) factor. Based on the arguments above and explorative analyses from the pilot study, we decided to construct one factor measuring performance expectancy regarding teaching (PE-teaching), and one factor covering work-integrated learning, i.e., support for teachers’ professional development (PE-teachers).

The performance expectancy for teaching (PE-teaching) covers: pupils’ own responsibility for their studies, individualization, active learning, being a “co-producer,” collaborating more with teachers and with other pupils, parent support and improved possibilities for receiving teaching material and feedback.

The performance expectancy for teachers (PE-teachers) covers items regarding potential for supporting the teachers’ professional development, e.g. collaboration, adopting new pedagogical concepts, and professional development.

The three different factors described above: Performance Expectancy-productivity/efficiency (PE-p/e) PE-teaching and PE-teachers are considered as sub-factors to PE, i.e., PE is a second-order factor in our model, see Fig. 3.

In total, performance expectancy was measured using 32 items, which were analyzed with confirmatory factor analysis (CFA), and items with a factor loading lower than 0.6 were excluded. This analysis resulted in keeping 19 items, of which five belonged to the first sub-factor PE-p/e, nine to the second (PE-teaching) and five to the third (PE-teachers), see Table 2. Three correlations between errors were identified within the factor PE-teaching. Analyzing item phrasing these correlations seems to be due to content overlap and correlations were used also in the final model.

Fig. 3. Performance expectancy as a second-order construct.
The final three factors are all illustrated in Table 3. *Effort expectancy*: This factor is very similar to the factor “ease of use” in the TAM2 model and in this case we only made some minor changes. All items had loadings ≥0.6 and were kept in the final model.

*Social influence*: We were inspired by the items found in the UTAUT model but changed wording to adjust it to a school setting and expanded the numbers of items.
in order to include municipality, school management, colleagues, pupils, parents, friends and family. The item “The school supports the use of ICT” suffered from missing values and was also highly correlated with the more specific item “The school administration supports the use of ICT,” which caused estimation problems. Consequently we decided to exclude this item from the analysis. Four items had loadings >0.6 and were kept in the final model.

*Facilitation:* This factor is inspired by the facilitation factor in the UTAUT model, but complemented with items of a more technological pedagogical focus. Out of the original ten items, five had loadings above 0.6 and were thus kept in the final model.

Due to the relatively small data set and the fact that the potential moderating variables showed low variability (e.g. 101 were females and 21 males), we did not include moderating factors in this study.

Since we wanted to develop a model for analyzing the current situation in a school setting, and since we wanted a model for the use of ICT in general and not a specific forthcoming technical artefact, we decided to study “Actual use” rather than

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**Table 3.** Items for the following factors: Effort Expectancy, Social Influence, Facilitation. Letters within brackets (a) indicate items with error correlation.

| Factor              | Items                                                                                                                                                                                                                                                                                                                                 |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Effort Expectancy   | The ICT which is available to me, I use without much effort (a). <br>The ICT which I have access to is easy to use (a). <br>For me, it is easy to do what I want to perform with the ICT I’ve had access to. <br>The ICT which I have access to is easy to use for the intended purpose.                                                                                      |
| Social Influence    | Colleagues who I listen to, tell me that I should use ICT. <br>My pupils think that I should use ICT. <br>Persons with parental responsibility for the pupil think that I should use ICT. <br>Family and friends believe that I should use ICT. <br>In general, the municipality supports the use of ICT. <br>In general, school administrators support the use of ICT. <br>In general, school administrators support the use of ICT (rejected due to multicollinearity).       |
| Facilitation        | In our school, we can get technical support when we use ICT. <br>Our school IT technician, educator, and administrators have a clear overview of ICT. <br>At my school a contact person is responsible for everything related to the use of ICT. <br>Our school technological pedagogical specialist has a well-defined role in the school. <br>In our school, we can get technological pedagogical assistance when we use ICT. <br>When I face problem with ICT, I receive help in a timely manner. <br>When I need help using ICT, there are instructions available for me to use. <br>I have access to sufficient technical resources to use ICT in teaching. <br>I have sufficient knowledge to be able to use ICT in teaching. <br>In our school, colleagues help each other when someone encounters problems with ICT. |
intention to use. It would make no sense to ask about intention for a number of ICT activities that already were implemented.

**Actual use:** To measure actual use we constructed a formative index. This index is based on a total of 39 items, of which 21 focus on actual use involving the teacher and 18 items focus on actual use by students, even though initiated by the teacher. The items cover the following aspects: use of ICT in class, use of ICT for administration, use of ICT for communication and collaboration (teacher-student, teacher-teacher and student-student). All items started with the phrase: How often do you… and the possible answers were: 1 = Never, 2 = More seldom, 3 = A few times every second week, 4 = sometimes (one to three times a week), 5 = Multiple times a week (minimum four times a week), 6 = Several times per day. The mean was calculated for all the questions regarding actual use by teachers and in the same manner questions regarding actual use by students were aggregated into mean values. The overall index for actual use was calculated as the average between the means for actual use by teachers and students, i.e., teachers and students’ adoption was given the same weight in the overall index for actual use. See Table 4 for a complete list of all items.

### 4. Results

Among the 103 responders, 84 were female (82%) and 19 male (18%). Five respondents were younger than 30 years old (5%), 41% were 31—44 years old and 54% were at least 45 years old. The pedagogical experience was: 70% with at least ten years’ experience, 12% 6—10 years’ experience and 18% with experience less than six years. Only 1% of the responders belonged to preschool, 44% grades 1—3, 33% grades 4—6, 20% grades 7—9 and 2% worked at an “after-school center.”

All factors showed a CR around 0.9 (good reliability). Furthermore, the convergent validity was satisfying since all AVE were above 0.5. Discriminant validity was adequate for all factors, since all inter-factor correlations were less than corresponding square root of AVE, see Table 5 for reliability and validity figures.

The model fit indices were: Cmin/df = 1.52, CFI = 0.86 and RMSEA = 0.07.

Thus, all factors showed good convergent validity and discriminant validity, as well as good reliability. The overall fit of the model was acceptable. The R-square for Actual Use was 0.14.

The target variable Actual use index showed a symmetrical distribution shape with no extreme values, and a mean of 2.8 (sd = 0.9), i.e., close to grade 3 (sig graded scale) meaning “A few times every second week.” The actual use index did not show any significant relationship with gender, age group, experience group or “grade” (p-values based on ANOVA: p > 0.20, p > 0.20, 0.089, p > 0.20, respectively).
Table 4. All items used for the formative construct: Actual use.

| Actual Use | Teachers                                                                 | Pupils                                                                 |
|------------|--------------------------------------------------------------------------|------------------------------------------------------------------------|
| Do you use the school’s learning platform to add material to an entire class? | Do you arrange the instruction in such a way that the students use the tablet in the lesson? |
| Do you use the school’s learning platform to provide individual feedback to students? | Do you arrange the instruction in such a way that the students use a special web page with the primary purpose of collecting information during the lesson? |
| How often do you use your laptop to prepare teaching? | Do you arrange the instruction in such a way that the students use a special web page with the primary purpose of training skills during the lesson? |
| How often do you use your iPad to prepare your lectures? | Do you arrange teaching in such a way that students use ICT to collaborate during the lesson? |
| Do you use your laptop during your lectures? | How often does your lecture build on the students themselves preparing for ICT before a joint assessment/evaluation? |
| Do you use your tablet (“iPad”) during your lectures? | How often does it happen that any student shows you digital material that contributes to course development? |
| How often do you use your laptop to show a presentation during the lesson? | How often does a student show you digital material that contributes to your own professional development? |
| How often do you use ICT as a support for the “flipped classroom”? | How often do students create digital text for hand-in task/presentation? |
| How often is the teaching based on the “flipped classroom” model? | How often do students create digital images for hand-in task/presentation? |
| How often do you use your “iPad” to show a presentation during the lecture? | How often do students create video for hand-in task/presentation? |
| Do you use the school’s learning platform to register as attending and non-attending students? | How often do your students use the national encyclopedia during lessons? |
| Do you use the school’s learning platform to document individual student effort and school-based achievement? | How often do students use a search engine (e.g. Google) during lessons? |
| How often do you use the school’s personal administration system? | How often do your students use Wikipedia during lesson |
Half of our hypotheses were confirmed, see Table 6. Digital living was significantly related to both performance expectancy and effort expectancy showing moderate correlations. Performance expectancy was significantly related to actual use, with a moderate correlation as well. However, neither effort expectancy, facilitation nor social influence were significantly related to actual use.

The relationships related to the hypotheses are also visualized in Fig. 4 together with the factor loadings for the sub-factors to performance expectancy. Performance expectancy significantly (all p-values < 0.001) loaded on all three sub-factors, reaching the highest estimates for the new sub-factors: PE-teaching and PE-teacher.

5. Discussion

Generally TAM or similar models are used in studies of adoption focusing on a technical artifact in itself. The ambition with this study was to go beyond the technical focus and also include technological pedagogical adoption. Furthermore, this study,

| Hypothesis                                      | Standardized Estimate | p-value | Conclusion  |
|-------------------------------------------------|-----------------------|---------|-------------|
| Digital living is positively correlated to      | 0.39                  | <0.001  | Supported   |
| performance expectancy                          |                       |         |             |
| Digital living is positively correlated to       | 0.36                  | <0.001  | Supported   |
| effort expectancy                               |                       |         |             |
| Performance expectancy is positively            | 0.30                  | 0.006   | Supported   |
| correlated to actual use                        |                       |         |             |
| Effort expectancy is positively correlated to    | 0.12                  | 0.212   | Not confirmed|
| actual use                                      |                       |         |             |
| Facilitation is positively correlated to         | −0.04                 | 0.710   | Not confirmed|
| actual use                                      |                       |         |             |
| Social influence is positively correlated to     | −0.15                 | 0.136   | Not confirmed|
| actual use                                      |                       |         |             |
in contrast to many other TAM studies, did not focus on any ICT artifact in particular, and instead covers a range of ICT tools and systems used in school. The study also included “digital living” as a new construct.

Even though the model reached an acceptable model fit, we believe that there is potential for further refinements. Regarding the performance expectancy, as a secondary construct, we believe that the factors PE-teaching and PE-teachers add important technological pedagogical items, but we still believe that these items could be further refined and complemented with more items focusing on “new pedagogies.” We also believe that the two new sub-dimensions could be refined further. The first one focuses on the teaching situation, to a large extent focusing on students, and collaboration between teachers and students (and parents), but naturally the teaching situation is also a situation for the teacher to develop new pedagogies together with the students. Thus, the PE-teaching dimension is to some extent also a part of continuing education for teachers, which is the main focus in the PE-teachers dimension. Further elaboration with these two dimensions would be favorable for making these sub-dimensions more distinct. Our suggested factor, digital living, showed a significant correlation with PE. The ambition was to measure “digital living” from a usability perspective, i.e., measuring if a person takes advantage and uses the benefits of ICT. That a person who broadly appreciates the advantages offered in the digitized society also identifies and expects advantages at work makes sense. And, as expected and consistent with TAM research in general, PE and actual use were also significant.
Digital living was also correlated with Effort expectation (EE). But to our surprise EE did not correlate with actual use. We could only speculate why this hypothesis could not be confirmed. We believe that the responders’ ICT skills from a technical point of view were rather homogenous and on a rather high level, i.e., that the EE simply was simply not a crucial factor for actual use. Technical skills are simply a necessary condition for actual use but not a sufficient condition. In light of such an explanation, we must admit that we failed with our ambition to focus on “technological pedagogical issues” for all factors. The EE includes phrases like “easy to use for the intended purpose,” which are very generic and may be interpreted mostly from technical perspectives. Instead, we should have developed items that specifically pinpoint technological-pedagogical issues, e.g. “I find it easy to find ways of using ICT that gives a pedagogical gain.” We know that many teachers do not have any problems using the technology, but don’t use it anyway, since they lack pedagogical incentives. Thus, if EE would focus more on efforts to find sound ways of using ICT in order to improve learning, the correlation between EE and actual use may have been significant, i.e., teachers who with low effort could see potential pedagogical gain are likely users while those who think it demands a lot of effort for pedagogical gain are unlikely users.

Neither of the hypotheses regarding relationships between social influence and actual use or between facilitation and actual use could be confirmed. One speculation is that these factors also should have included more specific items pinpointing the issue of pedagogical gain by using ICT. For instance, if the social norm is that ICT could improve learning, that would potentially be more important than just the norm that colleagues think you should use ICT without pointing out any specific rationale for the use. With the same argument, facilitation may also be tweaked further toward pedagogical gain, rather than just facilitation of technical issues. According to our experiences and cooperation with ICT specialists at school, their ambition and desire is to offer technological pedagogical support, but regretfully, mostly have to deal with technical support.

5.1. Implications for practice and research

If the model is refined further we believe that it could serve as a comprehensive tool to be used in practice. The results from an in-school survey based on the model could serve as a current state analysis and serve as a basis of discussion for taking the next step in adoption. We think such an approach could make impact in practice and serve as a complement to the conceptual TPACK model. An optimal solution would be if the survey could be administered on a platform and that several surveys could be aggregated in order to provide references of the general situation in comparable schools.

For researchers the model could serve as a basis for further research developing understanding for adoption, not only from a technological perspective, but more from a
pedagogical gain perspective. In general, our approach may be used in other situations, as a way of using TAM modelling beyond the technologically deterministic focus.

Regarding the developed factor “digital living,” we believe that this factor is important to consider in both research and practice. We believe that this factor is central with increasing digitization in general. And as a matter of fact, the national syllabus for K-12 in Sweden includes specific learning outcomes regarding digitization. A student is expected to understand how digitization affects the individual and society at large. The education should support students’ capacity to understand and use digital systems and services, and adopt a critical and responsible way of using provided information. In other words, a national learning outcome is very closely related to a “digital living” factor. What this means and how it could be achieved must be a joint concern for practitioners and researchers.

5.2. Limitations of the study

Even though this study is based on a pilot study, the actual study has a rather limited number of responses. From a statistical point of view, the response rate is generally a more important concern that the sample size itself, and this study had a high response rate, which to some extent compensates for the small sample size. Furthermore, our analytical approach is explorative, meaning that the results and significances should not be interpreted as confirmative proofs. The results must be confirmed in forthcoming studies, just as the model in itself need refinements.

6. Conclusion

This study contributes a suggested model for studying teachers’ adoption of ICT pedagogy in schools. The suggested model includes dimensions for measuring expected performance from a technological-pedagogical point of view. But further refinement is needed for measuring effort expectancy, social norm and facilitation. We found that expectancy, including pedagogical gain, related to actual use. Finally, a new factor (“digital living”) was introduced, and showed significant relation to both performance and effort expectancies. This factor may be of importance for future research of ICT use in school and other workplaces as well.

Declarations

Author contribution statement

Martin Gellerstedt, Said Morad Babaeidari, Lars Svensson: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.
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Competing interest statement

The authors declare no conflict of interest.

Additional information

Data associated with this study has been deposited at Mendeley Data under the accession number https://doi.org/10.17632/2f8p4ypdjn.1.

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