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Task-Technology Fit and Continuance of Use of Web-based Programming Tool: A Pilot Study

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Abstract. Web-based coding tools are widely accepted in computer science education. The use of these tools allows us to improve learning, but the requirement is to understand the factors that affect their acceptance. Carefully selecting technology that best suits the needs of the task will allow the optimal use of these tools in education. The purpose of this study is to develop a model that incorporates constructs of the Task-technology fit (TTF) model and the Expectation-confirmation model of IT continuance (ECM) to better understand the impact of the tool's suitability on the user's behavioral intention. The analysis was performed using the partial least squares approach to structural equation modeling. The results show a significant impact of task-technology fit factor on student satisfaction and their continuance intention. Consequently, this demonstrates that the proposed model is appropriate for understanding the acceptance of web-based programming tools in an educational context.

Keywords: Web-based Coding Tool · Task–technology fit · model of IT continuance · Introductory Programming Course · Empirical Study · Post-use Questionnaire · PLS-SEM

1 Introduction

Web-based coding tools are playing an important role in computer science education. Their importance is further enhanced by the increasing popularity of distance learning and Massive Open Online Courses. These tools offer many advantages over their desktop alternatives (presence on various platforms, available anywhere and anytime, needlessness for installation and maintenance, suitability for face-to-face and online teaching, and support for collaborative learning), although they have some disadvantages as well. Web-based technology offers opportunities for students to improve their learning, but it is necessary to identify the most effective methods of utilizing those tools in order to improve teaching and learning productivity [1]. Many studies have been conducted to investigate that problem and numerous models have been developed to describe and explain the process of tool adoption and choosing the right tool to solve a task. Goodhue and Thompson proposed a task-technology fit model and established the linkage between information systems and individual performance [2]. In that model, match between the capabilities of the technology to the demands of the task is expressed by the formal construct known as a task–technology fit (TTF). In the TTF model, task–technology fit is a function of task and technology characteristics. Numerous studies (e.g. [3][4]) have confirmed that TTF has an influence on user performance as predicted by the TTF model. In the educational context, task–technology fit refers to a learning system's capability to support users in performing their learning tasks. However, while the TTF model integrates technology and task characteristics and connects them through the use of technology with user performance, it does not contain any other factors that may influence technology use. Factors influencing the use of technology are explored by theories of technology acceptance. It has been studied over the years and many models have been developed to describe technology acceptance. Bhattacherjee [5] introduced the unified model of IT continuance in which user's intention to continue using information systems is determined by the confirmation of perceived usefulness, satisfaction with technology, and subjective norm. This model was used as a background for further research dedicated to the acceptance of IT technology by users. Numerous studies confirmed the model in different contexts (e.g. [6][7]). Also, the model has been validated and expanded in an educational context. Yang [8] analyzed quality factors that influence the continuance intention in the educational ecosystem. Boe [9] integrated IT Continuance Theory and agency theory (PAT) in higher education settings. Basnet et al. [10] explored students' continuance intention of the automated assessment system in computer science education. Haung [11] identified the importance of hedonic and utilitarian aspects in students' continuance intention toward programming games. Thongmak [12] examined the influence of satisfaction on continued engagement intention in the context of gamifying programming course. Orehovački and Babić [13] evaluated pragmatic and hedonic facets of quality on users' continuance intentions of games designed for learning programming. Current studies (e.g. [14]) have found that task–technology fit plays an important role in explaining users' e-learning continuance intentions. All of the above justifies the use of the IT continuance model in the context of learning programming and its extension with elements of the task-technology fit model. In this paper, we synthesized factors from the TTF model and the expectation-confirmation model of IS continuance to examine the impact of task-technology fit on student acceptance of web-based programming tool and role of satisfaction in that transition. The remainder of the paper is structured as follows. Research model and hypotheses are explained in next section. Research methodology is described in the third section. Findings are reported in the fourth section. Conclusions are drawn in the last section.

2 Research model and hypotheses

The proposed research model consists of three constructs adopted from the task-technology fit model: task characteristics, technology characteristics, and task-technology fit. Task characteristics refers to the particularities of a task that can be executed using a web-based coding tool. Technology characteristics denotes the features of a web-based coding tool that may affect its utilization by users. Task-technology fit is the degree to which a web-based programming tool assists students in completing problem-based tasks. Remaining two constructs (satisfaction and continuance intention) were adopted from the expectation-confirmation model of IS continuance. Satisfaction measures the extent to which students are pleased with the use of a web-based programming tool. Continuance intention refers to the degree to which students are willing to remain users of a web-based programming tool and recommend it to their peers. This study proposes that the adoption of a web-based coding tool will depend on how students perceive the fit of this technology to the problem-based tasks they are trying so solve by its means. The mentioned fit will also affect users' satisfaction with the tool, which will in turn contribute to their intention to use the tool. In accordance with the aforementioned, we propose the following five hypotheses:

H1: Task characteristics have a significant positive effect on task–technology fit.
H2: Technology characteristics have a significant positive effect on task–technology fit.
H3: Task–technology fit has a significant positive effect on continuance intention.
H4: Task–technology fit has a significant positive effect on satisfaction.
H5: Satisfaction has a significant positive effect on continuance intention.

3 Methodology

Empirical study was conducted as part of an ongoing project exploring the suitability of various educational tools for acquiring programming skills and their adoption by students. To date, we proposed a taxonomy of tools designed for learning programming [15], identified criteria for selecting the most appropriate tool in that respect [16], and introduced a model in which TAM model was tailored to the context of our research [17]. In this paper, we examined the adoption of a web-based programming tool within an introductory programming course. The sample was composed of undergraduate students enrolled in the Faculty of Informatics and Department of Computer Science of the Juraj Dobrila University of Pula in Croatia. Data were collected using a post-use questionnaire after lab sessions in which students used a web-based programming tool. In the introductory part of the questionnaire, basic demographic data on respondents (gender and age) were collected and the rest of the questionnaire consists of 17 five-point Likert scale items. These items were adopted from the same literature as their underlying constructs and tailored to the context of our research. The Repl.it tool was used as a representative sample of a web-based programming learning tool. This tool allowed students to work together on the same code, share code and work individually. Students could interact with each other while coding by using the chat feature. At the beginning of the session, features of the tool were briefly presented to students. The lab session included an introduction of a programming problem, a presentation of several solved problems, and a group analysis of the code. Students were also asked to use the aforementioned tool to independently solve several programming problems. The post-use questionnaire was created and distributed to study participants by means of Google Forms. The research model was analyzed with SmartPLS 2.0 M3 tool [18].

4 Findings

A total of 56 students participated in the study. The majority of them (73.2%) were male. At the time study took place, half of the respondents were 19 years old, 19.6% were 20 years of age, 14.3% were 21 years old while remaining 16.07% had between 22 and 25 years of age. Analysis followed guidelines suggested by Hair et al. [19] and included the assessment of the measurement and the structural model. First, the outer loadings for all latent variables were examined. All indicators met the criterion according to which their outer loadings should be 0.708 or higher which indicates that latent variables are explaining at least 50% of the variance of each indicator. Internal consistency reliability was tested using Composite reliability (CR) and Cronbach's alpha (CA). The values for both indicators in the context of all latent variables have exceeded the acceptable threshold of reliability (0.707). Therefore, the internal consistency reliability of items was confirmed. Values of AVE for constructs were in a range from 0.6211 to 0.8427 which is above the cut-off value of 0.50 indicating a satisfactory convergent validity. We tested discriminant validity by extracting the indicator's outer loadings on a construct and its cross-loadings with other constructs. Results indicated that all items' loadings on their respective constructs were above the threshold of 0.707 [20]. Furthermore, each item's factor loading on its respective construct was higher than on any other latent variable in the model. In that respect, this criterion of discriminant validity was met. Discriminant validity was further examined by comparing the square root of the AVE of particular latent variable with the correlation coefficients between this latent variable and remaining ones in the model. Considering the square root of AVE for all latent constructs was superior to the correlation coefficients, we concluded that the Fornell-Larcker criterion of discriminant validity [19] was achieved. Assessment of structural model included the evaluation of latent variables' determination coefficient values, the significance of the path coefficients, the effect size, and predictive relevance [19]. The values of determination coefficient for all dependent variables are above 0.5. Two exogenous variables (task characteristics and technology characteristics) explain 53.2% of variance in task-technology fit which in turn explains 63.9% of variance in satisfaction while 74.3% of the variance in continuance intention is explained by task–technology fit and satisfaction. In order to test the hypotheses, we conducted a bootstrapping analysis with 5000 samples. The strongest relationship was found between task–technology fit and satisfaction (β=0.7991, $p<0.001$) which was followed by the relationship between task–technology fit and continuance intention (β=0.5588, $p<0.001$) and the relationship between technology characteristics and task–technology fit (β=0.4797, $p<0.001$). On the other hand, relationships between task characteristics and task–technology fit (β=0.3377, $p<0.01$) and between satisfaction and continuance intention (β=0.3472, $p<0.05$) proved to be weaker. Since all paths in the structural model were statistically significant, all proposed hypotheses were confirmed. Values of effect size and predicting relevance of exogenous variables were interpreted in accordance with followed guidance [19]. We found that task–technology fit strongly affects continuance intention (f^2=0.43). On the other hand, the effect of satisfaction to continuance intention (f^2= 0.15), task characteristics on task–technology fit (f^2=0.16) and technology characteristics on task–technology fit (f^2= 0.32) proved to be moderate in size. The analysis of the research model also revealed that technology characteristics has moderate relevance in predicting task–technology fit (q^2=0.15). The same holds for task–technology fit in predicting continuance intention (q^2=0.16). All remaining exogenous latent variables have weak relevance in predicting endogenous latent variables.

5 Conclusion

The aim of this paper was to combine factors from expectation confirmation model with those of task technology fit model in order to understand to what extent features of a web-based programming tool and particularities of task that can be carried out by its means contribute to behavioral intentions related to the reuse of this tool. Findings presented in this paper are in line with those in current literature since they confirmed positive effects between constructs inherited from the aforementioned two models. More specifically, we found that in the context of the web-based programming tool adoption, degree to which a tool assists students in completing problem-based tasks has a significant positive effect on extent to which students are pleased with the use of that tool. We also found that technology fit has a medium-sized impact on students' willingness to remain users of the tool and to recommend it to their peers. This study has several limitations. It is based on the use of only one tool, and the sample was composed of students from a single university. Therefore, future studies with more participants from different institutions should follow proposed research direction in order to provide more insights into robustness of presented findings.

References

1. Sadaf, A., Newby, T.J., Ertmer, P.A.: An investigation of the factors that influence pre-service teachers' intentions and integration of Web 2.0 tools. Educational Technology Research and Development. 64(1), 37–64 (2015)
2. Goodhue, D.L., Thompson, R.L.: Task-Technology Fit and Individual Performance. MIS Quarterly. 19, 213–236 (1995)
3. Bere, A.: Applying an extended task-technology fit for establishing determinants of mobile learning: an instant messaging initiative. Journal of Information Systems Education. 29(4), (2019)
4. McGill, T. J., Klobas, J. E.: A task–technology fit view of learning management system impact. Computers & Education, 52(2), 496-508 (2009)
5. Bhattacherjee, A., Lin, C.-P.: A unified model of IT continuance: three complementary perspectives and crossover effects. European Journal of Information Systems. 24(4), 364–373 (2015)
6. Oghuma, A.P., Libaque-Saenz, C.F., Wong, S.F., Chang, Y.: An expectation-confirmation model of continuance intention to use mobile instant messaging. Telematics and Informatics. 33(1), 34–47 (2016)
7. Rahman, M.N.A., Zamri, S.N.A.S., Eu, L.K.: A Meta-Analysis Study of Satisfaction and Continuance Intention to Use Educational Technology. International Journal of Academic Research in Business and Social Sciences. 7(4), (2017)

8. Yang, M., Shao, Z., Liu, Q., Liu, C.: Understanding the quality factors that influence the continuance intention of students toward participation in MOOCs. Educational Technology Research and Development. 65(5), 1195–1214 (2017)
9. Bøe, T., Gulbrandsen, B., Sørebø, Ø.: How to stimulate the continued use of ICT in higher education: Integrating Information Systems Continuance Theory and agency theory. Computers in Human Behavior. 50, 375–384 (2015)
10. Basnet, R.B., Doleck, T., Lemay, D.J., Bazelais, P.: Exploring computer science students' continuance intentions to use Kattis. Education and Information Technologies. 23(3), 1145–1158 (2017).
11. Huang, Y.-M.: Students' Continuance Intention Toward Programming Games: Hedonic and Utilitarian Aspects. International Journal of Human–Computer Interaction. 36(4), 393–402 (2019)
12. Thongmak, M.: Gamifying the First Programming Class: Outcomes and Antecedents of Continued Engagement Intention. In: Proceedings of the International Conference on Information Systems Education and Research AIS SIGED (2017)
13. Orehovački, T., Babić, S.: Inspecting Quality of Games Designed for Learning Programming. In: Zaphiris, P., Ioannou, A. (eds.) LCT, HCII 2015. Lecture Notes in Computer Science, 9192, pp. 620-631. Springer, Heidelberg (2015)
14. Sørebø, Ø., Halvari, H., Gulli, V.F., Kristiansen, R.: The role of self-determination theory in explaining teachers' motivation to continue to use e-learning technology. Computers & Education. 53(4), 1177–1187 (2009)
15. Škorić, I., Orehovački, T., Ivašić Kos, M.: Learning to Code and Collaborate in a Web Environment. In: Proceedings of the AHFE 2018 International Conference on Human Factors and Systems Interaction. pp. 54-65. Springer, Orlando (2018)
16. Škorić, I., Pein, B., Orehovački, T.I.: Selecting the most appropriate web IDE for learning programming using AHP. In: Proceedings of the 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO). pp. 877–882. IEEE, Opatija (2016)
17. Škorić, I., Orehovački, T., Ivašić Kos, M.: Exploring the Acceptance of the Web-based Coding Tool in an Introductory Programming Course: A Pilot Study. In: Proceedings of the 3rd International Conference on Human Interaction and Emerging Technologies (IHIET 2020), Advances In Intelligent Systems and Computing, Springer, Paris (2020)
18. Sarstedt, M., Cheah, J.-H.: Partial least squares structural equation modeling using SmartPLS: a software review. Journal of Marketing Analytics. 7(3), 196–202 (2019)
19. Hair, J.F.: A primer on partial least squares structural equation modeling (PLS-SEM). SAGE Publications, Inc., Thousand Oaks (Calif.) (2017)
20. Hulland, J.: Use of partial least squares (PLS) in strategic management research: a review of four recent studies. Strategic Management Journal. 20(2), 195–204 (1999)