CASE Tools' Acceptance in Higher Education – Assessment and Enhanced UTAUT Model

Bartosz Marcinkowski
bartosz.marcinkowski@ug.edu.pl

Stanislaw Wrycza
swrycza@ug.edu.pl

Department of Business Informatics
University of Gdansk
Sopot, 81-864, Poland

Abstract

Unified Theory of Acceptance and Use of Technology (UTAUT) is widely used for the assessment of acceptance factors in different fields of business and IT. A number of studies focus on university teaching with regard of technology acceptance as well. The paper is devoted to elaborating enhanced UTAUT model that takes into account the specificity of Systems Analysis & Design discipline in order to verify CASE tool acceptance within university teaching process. Based upon previous research and experience, authors modified the classic UTAUT model by supplementing it with two additional variables: Professional Training Diffusion (PTD) as well as Model Interchange (MI). 12 research hypotheses were posed. Model introduced in the current article was verified by carrying out a two-stage study among regular and extramural students of MIS.

Keywords: UTAUT, Technology Acceptance Model Modifications, Systems Analysis and Design, CASE Tools, Higher Education, Model Interchange.

1. INTRODUCTION

Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003) right after its introduction, has attracted attention of the numerous IS scholars and is nowadays one of the fundamental IS theories of information technology and software acceptance. The model has enabled assessing levels of users' acceptance through direct measurement of intention to use the investigated information technologies as well as software. In order to achieve this goal, the influence of versatile independent variables on the selected IS/IT solutions usage – like m-commerce, social networking, WWW services use etc. – is taken into account. Moreover, UTAUT has given an opportunity to execute acceptance surveys within not strictly IT-related, but still technology-oriented areas – such as consumer goods, services or engineering applications. In the primary UTAUT research model four major independent variables are introduced – performance expectancy, effort expectancy, social influence as well as facilitating conditions. The model introduces and considers four moderators – gender, age, experience, and voluntariness of use. The variables are in fact interconnected. Independent variables are quantified by measuring data values gathered for the sets of the related thematic questions attributed to the specific variable. The UTAUT model enables identification of the reasons of certain behavioral intention – and consequently behavior itself, i.e. use of the specific technology or software. The higher the level of usage intention, the higher

the probability that the specific software or technology shall be used in the future.

Software acceptance models, including UTAUT, are interdisciplinary in nature. The models include elements of business informatics, statistics, psychology and sociology mainly. A number of alternative models were proposed till now, not counting numerous their modifications. Apart from the UTAUT model, the following acceptance models are considered significant: TAM (Davis, Bagozzi and Warshaw, 1989), TPB (Ajzen, 1991), IDT (Moore and Benbasat, 1991), MM (Davis, Bagozzi and Warshaw, 1992), C-TAM-TPB (Taylor and Todd, 1995), SCT (Compeau and Higgins, 1995), TAM2 (Venkatesh and Davis, 2000) as well as TAM3 (Venkatesh and Bala, 2008). Venkatesh et al. (2003) analyze eight of the models in the context of UTAUT proposal.

The paper comprises 5 sections. After the Introduction, the comparative analysis of publications regarding different applications of UTAUT model and its extensions in university teaching is presented in section 2. In the third section, relevance of both CASE tools and UML in higher education is outlined. The fourth section introduces the enhanced UTAUT model as well as research hypotheses. After that, the fifth section concludes the article as well as lays out related research.

2. LITERATURE REVIEW

The classic UTAUT model was a relatively successful proposition. It raised the bar up to 70% in terms of predicting technology adoption success (Schaper and Pervan, 2007), while TAM and TAM2 models being successful only in 30% and 40% of the cases respectively (Oye, Iahad and Rahim, 2014). Nevertheless, UTAUT itself has inspired many researchers to accomplish the studies of user acceptance of information technology and software. The versatility of research contributions may be categorized into two main research tracks:

- applications of classic UTAUT research model in a number of areas, including technology, software and business;
- enriching and extending classic UTAUT model, by supplementing major variables and/or moderators with the subject-related independent variables or moderators.

The study performed by Williams et al. (2011) revealed that UTAUT (along with its modifications) constituted the most popular model of IT/IS technology acceptance research resulting in 870 citations. However only 43 of the citations are related to publications with the empirical application of this theoretical model in 4 major categories proposed by Lee, Kozar and Larsen (2003), i.e. communications systems, general-purpose systems, specialized business systems as well as office systems. Sticking to the methodology used to perform the study, by the middle of Jan, 2015 the number of citations related to the original UTAUT article has reached as many as 2756 citations recognized by Thomson Reuters Web of Science.

Numerous proposals encouraged V. Venkatesh to add another level of complexity to the UTAUT itself. In result, UTAUT2 was proposed (Venkatesh, Thong and Xu, 2012), introducing such new constructs as hedonic motivation, price value and habit. Having said that, resulting model deviates significantly from the current research – which is concentrated around investigating acceptance of systems modeling tools.

As stated before, the classic UTAUT research model has been modified by introducing various independent variables and moderators. Technology acceptance researchers have identified and selected different factors with respect to the perceived specificity of the technology area and theoretical assumptions of the research. The choice of variables having impact on the architecture of the model proposed depends on researchers' creativity, concept and user requirements. Practically, the independent variables of the specific models were the mixture of the selected classic UTAUT variables and the evaluated new, domain-specific ones. The same statement may be applied to UTAUT moderators being introduced. Therefore, UTAUT model was found to be very flexible in terms of identification, selection, elaboration and application of independent variables and moderators. The review of the adequate domain-related publications shows that the broad number of variables and moderators extensions has been proposed and evaluated. As regard to UTAUT variables, they include first and foremost: attainment value, trust, attitude, perceived risk, experience, credibility, resistance to change or relevance. With respect of moderators, it is worth to mention: anxiety, training, objective norms IT knowledge as well as habit. The latter was proposed by Pahnila, Siponen and Zheng (2011).

The special interest in this article has been concentrated around the UTAUT application for university teaching. Marques, Villate and Carvalho (2011) verify the adequacy of UTAUT model in respect of applying information technologies in pedagogical processes in higher education. UTAUT validation in university educational context is provided by Wong, Teo and Russo (2013). The article is an example of classic UTAUT model application with regard to Interactive Whiteboard acceptance. Marchewka, Liu and Kostiva (2014) applied primary UTAUT model to understand student perceptions using Blackboard web-management tool, containing a number of functionalities such as online discussion board, course content management, auto-marked quizzes and exams or grade maintenance. The results of the research aimed at evaluating course satisfaction of students in respect of the active learning are presented by Taneja (2009). It is mostly e-learning that is the teaching technology that attracts the UTAUT researchers – like educational webcasts' adoption (Giannakos and Panayiotis, 2011), ease of use and usefulness of webinars in an open distance learning environment (van der Merwe and van Heerden, 2013) or mobile learning adoption (Prieto, Miguelanez and Garcia-Penalvo, 2014). The scope of the variables and moderators is versatile, confirming the flexibility of the UTAUT model. Phahlane and Kekwaletswe (2014) developed a UTAUT-based model that is utilized to analyze the use of Management Information Systems in higher education environment in South African institutions. In their study, authors introduce five variables that are hypothesized to positively influence both UTAUT's performance expectancy and effort expectancy, i.e. users' characteristics, fit characteristics, system characteristics, management characteristics as well as organizational characteristics. The research is aimed at assisting decision makers in directing investment by showcasing what areas of MIS users find useful and where improvements can be made.

The application of UTAUT for e-learning acceptance is presented inter alia in (Roca, Chiu and Martinez, 2006), (Islam, 2011) and (Sorebo et al., 2009). In the former publication, authors introduced a series of extensions into the classic UTAUT model, proving that learners' satisfaction is shaped by such variables as perceived quality, perceived usability and perceived control as well – not being significantly affected by subjective norms. In the latter publication, the independent variables include satisfaction of use and perceived usefulness. The last factor is dependent on confirmation of teachers' expectations and perceived competence. Similar studies and the relevant model itself were subjects of series of improvements, published in the recent years. With regards of e-learning adaptation, Sumak, Polancic and Hericko (2010) have analyzed the intention behavior of an open source e-learning platform – Moodle. The study confirmed that performance expectancy and social influence have a significant impact on students' intention to use Moodle. Xiong et al. (2014) perform literature review aimed at investigating what potential factors affect the adoption of Massive Online Open Courses (MOOCs) by students. As a result, authors extend classic UTAUT by introducing additional variable – human capital. It is the intention of e-learning use that is the subject of survey by Alrawashdeh, Muhairat and Alqatawnah (2012) as well. The proposed model is significantly different compared to the classic UTAUT model. The authors abandoned using any moderators. However, they described interchangeably two independent variables – performance expectancy and effort expectancy – with system enjoyment and system interactivity. Additionally, study involved investigating the relevance of system flexibility in respect of shaping behavioral intentions.

Another example of the UTAUT application for university teaching is the advanced research of the acceptance of the electronic library use, as presented in (Tibenderana and Ogao, 2008) by using the modified model SOUTAUT – Service Oriented UTAUT. Original model was modified by introducing new essential variables, i.e. relevance as well as expected benefits. It is the latter variable in particular that is the novel contribution of research carried out. The extensive studies of the authors have confirmed the strong influence of the behavior (use of the library service to be exact) on the expected benefits. In this domain of the research, the intention for using tablets by the students of business schools was analyzed and explained (Anderson, Schwager and Kerns, 2006) on the basis of UTAUT model. It revealed a strong influence of the performance expectancy on the final student's preferences, while the other variables had minor impact on intentions.

The research in this paper focuses on the professional training-related CASE-supported courses at the Department of Business Informatics. The authors of the current paper have long experience in university teaching, so

the cases and examples analyzed above inspired them to take up the acceptance research based on UTAUT model. The goal of the paper is tailoring the classic UTAUT model to specific needs of CASE tool acceptance within university teaching process by identifying and introducing additional variables to the classic UTAUT model as well as evaluating intention to use an UML-oriented CASE tool within Systems Analysis & Design discipline with the enriched model.

3. RELEVANCE OF UML AND CASE TOOLS IN HIGHER EDUCATION

The literature review regarding UTAUT research in respect of university teaching revealed that the issue on system analysis, its techniques, methods and tools has not been the matter of the adequate acceptance surveying. This conclusion encouraged the authors to take up the initiative of filling the relevant gap in this respect. Results of both UML and CASE tools acceptance research may be of great value to the future IT professionals that consider implementing the methods in question in everyday IT practice.

It is the Unified Modeling Language (UML) that is the leading modeling technique within Systems Analysis & Design discipline. The UML, maintained by Object Management Group, may be used in conjunction with diverse system design-oriented approaches, from classic waterfalls-based approaches through robust methodology libraries (such as Rational Unified Process; RUP) to a wide family of Agile methods. Moreover, UML usage is not limited to strictly IT-oriented fields of application – owing to its universal nature the standard can be applied in different technology or business-related domains. Having said that, one should keep in mind that supporting such domains UML would have to directly compete with more specialized languages and notations – just to mention OMG Systems Modeling Language and Business Process Model and Notation. Up to date, the significance of UML as a leading modeling standard was confirmed twice by re-publishing it by ISO (International Organization for Standardization, 2005), (International Organization for Standardization, 2012). Hence, UML is included in curricula of IT-related majors throughout the world.

It is the complexity of the standard that is one of the major criticisms of the Unified Modeling Language. As a whole, UML is considered very complex – from two up to eleven times more complex than other modeling methods (Siau and Cao, 2002). Necessity to cope with diverse, specialized ITC application areas was the driving factors of introducing more and more of official and non-official UML profiles as well as growth of the standard itself. Practically, UML usage relies on the proper selection and application of the most suited diagrams and modeling categories to the specific information system functionality and/or structure aspects. A rich set of 14 types of the diagrams is available to a system designer within the process of information system modeling, supported by 15 official profiles, i.e. TelcoML, TelcoML-SES, BPMNProfile, CORP, CCMP, CCCMP, EAI, EDOC, MARTE, QFTP, SPTP, SoCP, SDRP, VOICP as well as UTP (Object Management Group, 2014). Due to the aforementioned complexity-related criticisms, not only researchers came up with so called light or minimal versions of UML superstructure – but Object Management Group itself elaborated a reduced UML 2.5 specification in parallel to the mainstream of UML specification development as well.

In order for modeling standards to be effective, they are supported by a number of CASE tools. The market diversity of CASE tools that are strictly dedicated to implementing UML within information system design process or simply provide a wide support for it as one of the modeling languages being supported may be described as vast. There are several dozens of modeling tools that both support UML and offer functionality entitling to classify the software as CASE tools listed in directories such as (Martinig & Associates, 2014). UML Vendor Directory Listing (Object Management Group, 2012) itself includes UML-oriented modeling software from 60 different vendors.

The question of acceptance of the specific information technologies and software (in this very case – CASE tools) by students is a vital factor for academic teaching objectives and syllabi. It has inspired the authors to assess the UML CASE tool acceptance of the university courses within systems analysis & design discipline. The results of research had twofold effects – reconsidering the program of the courses held as well as strengthening professional knowledge and practical skills acquired by students that were successful at qualifying for a new IT specialization at the University of Gdansk, Poland – IT Applications in Business. It was the Enterprise Architect by Sparx Systems that was pre-selected and recommended by instructors for the CASE tool

acceptance research. Pre-selection was performed by staff actively engaged in systems analysis & design teaching/professional training taking into account a rich set of criteria, including 24 items. First of all, criteria were formulated around the scope of the methodological support for well-known modern standards and languages:

- scale of UML 2.4 support,
- scale of SysML 1.3 support,
- scale of BPMN support,
- number of languages and database schemas supported by code generation feature

Secondary criteria addressed challenges such as reverse engineering support, round-trip engineering support, scale of DFD/ERD support, viability of client-server tool implementations as well as cloud-based tool implementations. In order to fulfill required role within offered university courses, the CASE tool should offer model interchange-related features, support for model transformations and diagram generation based on structured use case scenarios as well as GUI of high-grade ergonomics and quality. Not only technical criteria were analyzed – authors included market-oriented criteria as well – such as range of customer support, market share or range of sales network. Cost-oriented criteria taken into account included purchase costs, additional licensing costs and availability of trial/free of charge editions for personal use by students. Last but not least, no of job offers including selected tool on regional market, presence and quality of vendor's academic program, quality of training content published by the vendor, OMG partnership as well as awards/success stories among recognized universities were included in the analysis.

The EA tool had primarily an impact on systems analysis & design course. In the subsequent semesters, the students had a chance to re-integrate their CASE tool-related professional skills within such courses as object-oriented programming, databases, object-oriented systems design or business process modeling / workflow management. Consequently, students taking part in the survey possessed the knowledge as well as skills required to evaluate selected CASE tool and compare it with competing products. The acceptance of software by an individual user has prevailing influence on its later purchase and adoption in the rudimentary IS/IT activities in business. Therefore identification of the variables that have the strongest influence on behavioral intention to a certain degree determines the prerequisites and future sales strategy of the specific software.

4. ENHANCED UTAUT MODEL

The proposed research model includes 6 independent variables. Four of the variables are taken directly from the classic UTAUT model, i.e. Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) as well as Facilitating Conditions (FC). Considerations of the specificity of research domain led to introducing two additional variables – Professional Training Diffusion (PTD) and Model Interchange (MI) – that are tailored to description of CASE tools use. PTD was recognized as an important factor of CASE tools acceptance. It depicts the perceived flexibility and expressiveness of the tool in question in terms of modeling notations supported as well as problem areas that may benefit from introducing the tool within teaching process and further professional business practice. PTD (Professional Training Diffusion) is the specific variable for multi-standard CASE tools that enable using numerous standards in conjunction, interchanging modeling constructs and creating robust models. EA evolved to a package of over 20 modeling techniques (such as UML, BPMN, SysML and other) that may be expanded to de new roles and new teaching courses. The second independent variable enhancing the classic UTAUT model – MI – concentrates on the ability of the tool to integrate seamlessly with external tools in the company – in particular with other modeling-oriented tools as well as software that is able to interpret XML-based export models in areas that go beyond modeling. This feature becomes crucial especially when company decides to integrate CASE tools with dedicated transformation- or simulation-oriented environments.

Data were collected taking into account three UTAUT moderators – Gender, Age as well as IT Usage Experience. The fourth of primary UTAUT moderators, i.e. Voluntariness of Use, was not included in the model – due to the fact that EA was selected as primary tool supporting courses offered. At this stage of research, the significance of impact of individual moderators within the sample collected was not subject of analysis. The enhanced UTAUT model is presented at Figure 1. Each of the variables included in the modified UTAUT model was supported by a set of three to four research questions. Thus, quantitative analysis of the

influences among the variables was made possible.

With regard to the enhanced UTAUT model, the succeeding 12 hypotheses for verification were made:

H1: The student's performance expectancy will have a positive effect on behavioral intention to use EA tool;
H2: The student's effort expectancy will have a positive effect on behavioral intention to use EA tool;
H3: The social influence will have a positive effect on behavioral intention to use EA tool;
H4: The professional training diffusion will have a positive effect on behavioral intention to use EA tool;
H5: The model interchange capability will have a positive effect on behavioral intention to use EA tool;
H6: The professional training diffusion will have a positive effect on facilitating conditions that support the use of EA tool;
H7: The facilitating conditions will have a positive effect on students' effort expectancy regarding the use of EA tool;
H8: The model interchange capability will have a positive effect on students' effort expectancy regarding the use of EA tool;
H9: The students' effort expectancy will have a positive effect on students' performance expectancy regarding the use of EA tool;
H10: The social influence will have a positive effect on students' performance expectancy regarding the use of EA tool;
H11: The professional training diffusion will have a positive effect on students' performance expectancy regarding the use of EA tool;
H12: The model interchange capability will have a positive effect on students' performance expectancy regarding the use of EA tool.

5. RESEARCH OVERVIEW AND CONCLUSIONS

In order to investigate the students' behavioral intention to accept CASE tool in course of the university teaching process, authors of the article tailored the classic UTAUT model to specific needs of teaching process. The original works of V. Venkatesh's team were developed by integrating additional variables, i.e. model interchange as well as professional training diffusion. Thus, research contributed to development of domain-specific enhanced UTAUT model by utilizing previous adequate studies and including novel relationships between individual variables.

The enhanced UTAUT model in discussion was a subject of an empirical study and verification. Empirical data was collected in two closely related stages. Data provided by 196 participants was a subject of further research. The questionnaire was distributed among participants using Google Forms. 29 questions were presented to respondents – 24 of them were domain-specific, while remaining five were administrative in nature. Domain-specific questions were addressed using 7-degree Likert scale. Consistent with the original UTAUT study, gender was recorded as binary variable while both age and IT usage experience was captured as a continuous variable. Additionally, questionnaire study participants were expected to specify type of university and mode of study (regular and extramural) – both on a binary scale.

Based on the quantitative data collected, data reliability was analyzed using Cronbach's Alpha coefficients for each variable that was assigned a group of three to four specific questions. The hypotheses were tested by verifying both estimates and significance levels of individual interconnections related to the hypotheses. Fit indices of the target model were calculated and analyzed as well. In-depth discussion of study results surpass the scope of the current article.

The result of this research may be found useful by primarily two groups of professionals:

- academic teacher of information systems development,
- system analysts and designers.

The model elaborated as well as selected survey results are already being implemented in practice. Analyses performed are taken into account during curriculum development of the new Master studies at the University of Gdansk, Poland – IT Applications in Business.

6. REFERENCES

Ajzen, I. (1991). The Theory of Planned Behavior. *Behavior and Human Decision Processes, 50*.

Alrawashdeh, T.A., Muhairat, M.I., & Alqatawnah, S. (2012). Factors Affecting Acceptance of Web-Based Training System: Using Extended UTAUT and Structural Equation Modeling. arXiv preprint arXiv:1205.1904.

Anderson, J., Schwager, P., & Kerns, R. (2006). The Drivers for Acceptance of Tablet PCs by Faculty in a College of Business. *Journal of Information Systems Education, 17*(4).

Compeau, D.R., & Higgins, C.A. (1995). Computer Self Efficacy: Development of a Measure and Initial Test. *MIS Quarterly, 19*.

Davis, F.D., Bagozzi, R.P., & Warshaw, P.R (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science, 35*(8).

Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (1992). Extrinsic and Intrinsic Motivation to Use Computers in the Workplace. *Journal of Applied Social Psychology, 22*(14).

Giannakos, M., & Panayiotis, V. (2011). Identifying the Predictors of Educational Webcasts' Adoption. In *Proceedings of the 16th Annual Joint Conference on Innovation and Technology in Computer Science Education*. ACM.

International Organization for Standardization (2005). ISO/IEC 19501:2005. Information Technology – Open Distributed Processing – Unified Modeling Language (UML) Version 1.4.2. Retrieved May 20, 2015 from http://www.iso.org/iso/catalogue_detail.htm?csnumber=32620.

International Organization for Standardization (2005): ISO/IEC 19505-2:2012. Information Technology – Object Management Group Unified Modeling Language (OMG UML) – Part 2: Superstructure. Retrieved May 20, 2015 from http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=52854.

Islam, A.K.M.N. (2011). The Determinants of the Post-Adoption Satisfaction of Educators with an e-Learning System. *Journal of Information Systems Education, 22*(4).

Lee, Y., Kozar, K.A., & Larsen, K.R.T. (2003). The Technology Acceptance Model: Past, Present and Future. *Communications of the Association for Information Systems, 12*(1).

Marchewka, J.T., Liu,C., & Kostiwa, K. (2014). An Application of the UTAUT Model for Understanding Student Perceptions Using Course Management Software. *Communications of the IIMA, 7*(2).

Marques, B.P., Villate, J.E., & Carvalho, C.V. (2011). Applying the UTAUT Model in Engineering Higher Education: Teacher's Technology Adoption. In *Information Systems and Technologies (CISTI), 2011 6th Iberian Conference on*. IEEE.

Martinig & Associates (2014). UML Unified Modeling Language Tools: use cases, class diagram, sequence diagram, object diagram, MDA. Retrieved Jan 14, 2015 from http://www.umltools.net.

Moore, G.C., & Benbasat, I., (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research, 2*(3).

Object Management Group (2012). UML Vendor Directory Listing. Retrieved May 20, 2015 from http://uml-directory.omg.org/vendor/list.htm.

Object Management Group (2014): OMG® Specifications: UML Profile Specifications, http://www.omg.org/spec.

Oye, N.D., Iahad, N.A., & Rahim, N.A. (2014). The History of UTAUT Model and its Impact on ICT Acceptance and Usage by Academicians. *Education and Information Technologies, 19*(1).

Pahnila, S., Siponen, M., & Zheng, X. (2011). Integrating Habit into UTAUT: The Chinese eBay Case. *Pacific Asia Journal of the Association for Information Systems, 3*(2).

Phahlane, M.M., & Kekwaletswe, R.M. (2014). Management Information Systems Use in Higher Education Environments. In *Proceedings of the Southern Association for Information Systems Conference*. AIS.

Prieto, J.C.S., Miguelanez, S.O., & Garcia-Penalvo, F.J. (2014). Mobile Learning Adoption from Informal into Formal: an Extended TAM Model to Measure Mobile Acceptance Among Teachers. In *Proceedings of the Second International Conference on Technological Ecosystems for Enhancing Multiculturality*. ACM.

Roca, J.C., Chiu, C.M., & Martinez, F.J. (2006). Understanding e-Learning Continuance Intention: an Extension of the Technology Acceptance Model. *International Journal of Human-Computer Studies, 64*(8).

Schaper, L.K., & Pervan, G.P. (2007). ICT and OTS: A Model of Information and Communication Technology Acceptance and Utilizations by Occupational Therapist.

International Journal of Medical Informatics, 76.

Siau, K., & Cao, Q. (2002). How Complex is the Unified Modeling Language? In *Advanced Topics in Database Research*. Idea Group Publishing.

Sorebo, O., Halvari, H., Gulli, V.F., & Kristiansen, R. (2009). The Role of Self-determination Theory in Explaining Teachers' Motivation to Continue to Use e-Learning Technology. *Computers & Education, 53*(4).

Sumak, B., Polancic, G., & Hericko, M. (2010). An Empirical Study of Virtual Learning Environment Adoption Using UTAUT. In *Mobile, Hybrid, and On-Line Learning, 2010. ELML'10. Second International Conference on*. IEEE.

Taneja, A. (2009). The Influence of Personal Response Systems on Students' Perceived Learning Outcomes and Course Satisfaction. *Journal of Computing Sciences in Colleges, 25*(2).

Taylor, S., & Todd, P.A. (1995). Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research, 6*(2).

Tibenderana, P.K., & Ogao, P.J. (2008). Acceptance and Use of Electronic Library Services in Ugandan Universities. In *Proceedings of the 8th ACM/IEEE-CS joint conference on Digital libraries*. ACM.

van der Merwe, T.M., & van Heerden, M.E. (2013). Ease of Use and Usefulness of Webinars in an Open Distance Learning Environment: an Activity Theory Perspective. In *Proceedings of the South African Institute for Computer Scientists and Information Technologists Conference*. ACM.

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences, 39*(2).

Venkatesh, V., & Davis, F.D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science, 46*(2).

Venkatesh, V., Morris, M.G., Davis, F.D., & Davis, G.B. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*.

Venkatesh, V., Thong, J.Y., & Xu, X. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly, 36*(1).

Williams, M., Rana, N., Dwivedi, Y., & Lal, B. (2011): Is UTAUT Really Used or Just Cited for the Sake of It? A Systematic Review of Citations of UTAUT's Originating Article. In *ECIS 2011 Proceedings*. Elsevier.

Wong, K.T., Teo, T., & Russo, S. (2013). Interactive Whiteboard Acceptance: Applicability of the UTAUT Model to Student Teachers. *The Asia-Pacific Education Researcher, 22*(1).

Xiong, J., Tripathi, A., Nguyen, C., & Najjar, L. (2014). Information and Communication Technology for Development: Evidence from MOOCs Adoption. In *Proceedings of the Ninth Midwest Association for Information Systems Conference*. AIS.

ISSN: 2167-1508
v8 n3671

Appendices and Annexures

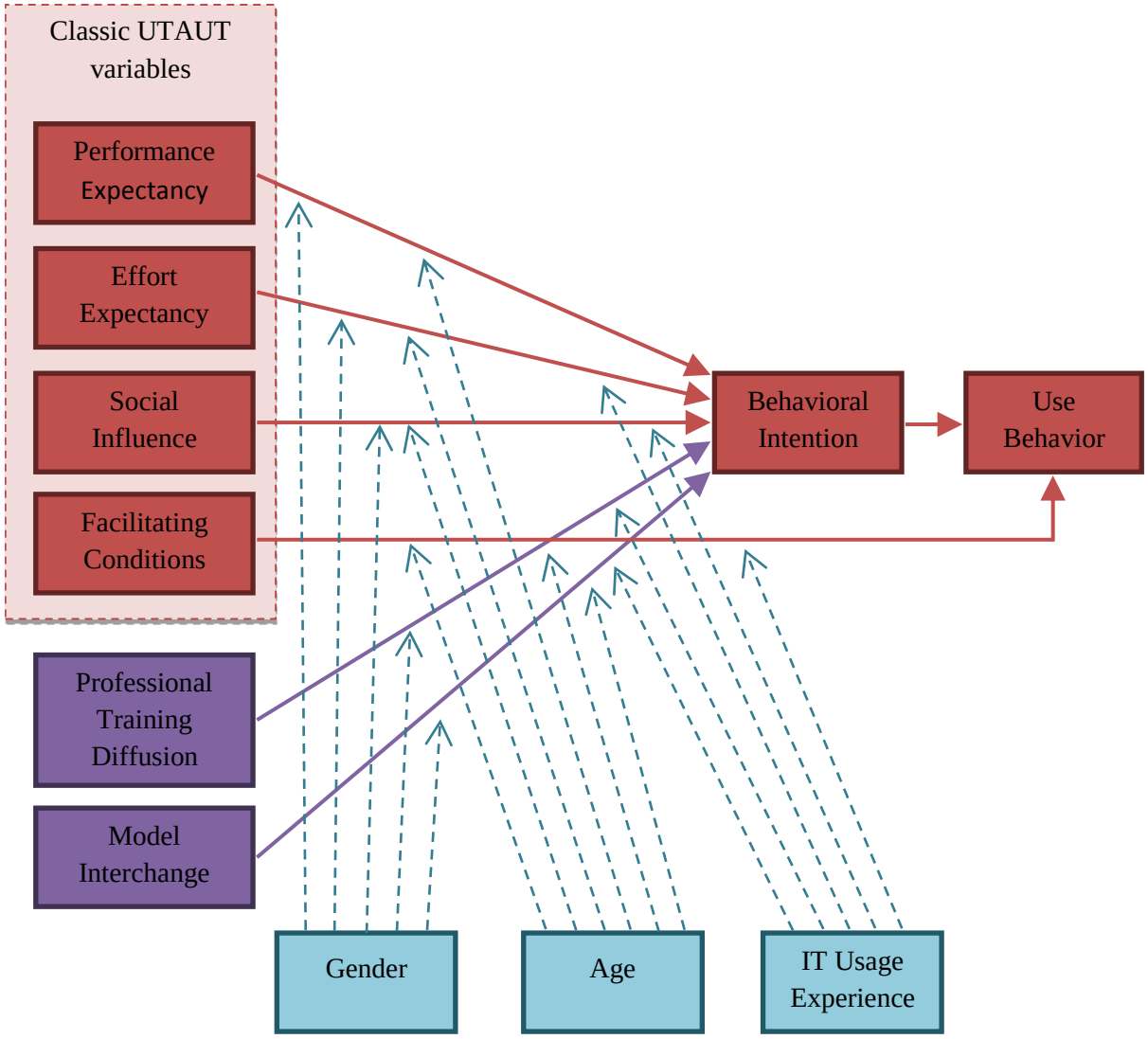

Figure 1: Enhanced UTAUT model for acceptance of UML-related CASE tools