STUDENTS' BEHAVIORAL INTENTIONS REGARDING THE FUTURE USE OF STATISTICAL METHODS

Polona Tominc, Maruša Krajnc, Klavdija Vivod, Blaž Frešer
University of Maribor, Faculty of Economics and Business
Razlagova 14, 2000 Maribor, Slovenia
polona.tominc@um.si

We study the economics and business studies students' attitudes, towards the usage of statistical methods, as the antecedent of their behavioral intentions to use them in the future. Attitudes revealed to be a strong factor in the process of shaping these intentions. In this research the conceptual model based on the Technology Acceptance Model (TAM) was developed and tested. Although TAM has been already used in the past researches to predict the behavioral intentions about the future use of statistical methods, our research brings additional insights by extending the model with several external factors as antecedents of students' attitudes (such as students' personal characteristics, fear of statistics and support of teacher). Research results provide important information for practitioners, educators, lecturers and curricula management teams.

INTRODUCTION

The main goal of the research is to determine, which critical factors are important in the process of shaping the behavioral intentions to use statistical methods in the future, by master's degree students of economics and business study program. The main frame of this research is the Technology Acceptance Model (TAM) (Fishbein & Ajzen, 1975), extended with selected external factors. The main objective of the research is to test the impact of critical factors on behavioral intentions to use statistical methods in the future, as well to test the extended model with the external factors. The preliminary research, conducted so far, brings insight into the relationships among the multidimensional variables of the model. In conclusions the plan of further research is described as well.

THEORETICAL BACKGROUND

The model of critical factors for shaping behavioral intentions – future use of statistical methods, is based on the TAM. It was originally developed from the Theory of Reasoned Action (TRA), as a model to test users' acceptance and behavioral intentions to use a certain technology (Fishbein & Ajzen, 1975; Šebjan & Tominc, 2015). TAM is among the most widely and the most frequently used models, aimed at research and forecasting the acceptance of information technologies and software solutions, as well.

Venkatesh & Davis (1996) emphasize, that model TAM consists of four main constructs, influencing the behavioral intentions of the future use: perceived ease of use, perceived usefulness, external variables (a group of constructs) and attitudes towards the future use. The perceived usefulness is defined as the degree to which a person believes that using a particular system would improve his work efficiency, while the perceived ease of use relates to the degree to which a person believes that the use of a particular system would be effortless (Davis, 1993). External constructs include factors such as user education, user participation and involvement, system characteristics, the nature of the implementation of the process (Venkatesh & Davis, 1996; Dizon 2016). The TAM model was expanded by researchers and included several external variables that could be identified as the following factors: technological factors, social factors, psychological factors, individual and behavioral factors (Šebjan & Tominc, 2015).

In the framework of the present research, besides the original constructs of TAM, the model of behavioral intentions to use statistical methods in the future, was expanded with the following external factors: (a) pedagogical support in the study process, (b) perceived compliance of statistical methods with the study demands, (c) statistics anxiety and personal characteristics of individuals: (d)

In M. A. Sorto, A. White, & L. Guyot (Eds.), *Looking back, looking forward. Proceedings of the Tenth International Conference on Teaching Statistics (ICOTS10, July, 2018), Kyoto, Japan.* Voorburg, The Netherlands: International Statistical Institute. iase-web.org

ambitiousness and innovation, (e) engagement and motivation and (f) research orientation and analytical thinking.

Pedagogical support in the study process in subjects from the field of quantitative methods: Within the study, which was related to the analysis of intentions for the future use of statistical software support SPSS, Šebjan & Tominc (2015) concluded, that teachers' support significantly contributes to the easier use of SPSS. The findings showed that teacher support has a positive and important influence on the perceived "ease of use of SPSS" and that "teachers' support" has a positive, but insignificant effect on the perceived "usefulness of SPSS". Therefore, we assumed that a similar relationship also applies to modeling intentions about the future use of quantitative statistical methods.

Compliance with the study needs: Undergraduate studies in statistics subjects mainly cover data management, data analysis and numerical analysis. At the master's level of study, however, this is a more demanding application of statistics, with emphasis on multivariate methods. At the doctoral program, the goal is for the students to independently use tools for statistical research. Some subjects require research activities, i.e. data collection and analysis, for which students need statistical knowledge. However, the level of knowledge is increasing with regard to the level of education. Šebjan & Tominc (2015) found that there is a link between the perceived compliance with the study needs, the use of SPSS and the future intentions of using SPSS, or that the perceived compliance with the needs of the study positively affects the perceived usefulness of SPSS and the future intentions of using SPSS.

Statistical anxiety: Anxiety is an undefined experience of endangerment, discomfort and disturbance that develops out of fear and anxiety, not stemming from an existing but rather anticipated situation; unlike anxiety, it is a generalized emotional state arising from a subjective problem (Marjanovič Umek et al., 2004). Anxiety can also affect the ability to acquire knowledge and skills in statistics (Hsu, Wang & Chiu, 2009).

Personal characteristics of individuals: In our research, we expanded the model by external factors that describe individual characteristics that may be important when perceived ease of use and perceived usefulness of statistical methods are shaped by individuals. Namely, the individual characteristics (more widely described as personal-level characteristics) of individuals were identified as important antecedents of certain behavioral intentions (Krueger, Norris & Carsrud, 1993; Linan & Alain, 2015; and others).

DATA AND METHODS

The survey was conducted among students of the master cycle study program Economics and business, at the University of Maribor, Faculty of Economics and Business, in January 2017 (n=101). Research model is presented in Figure 1.

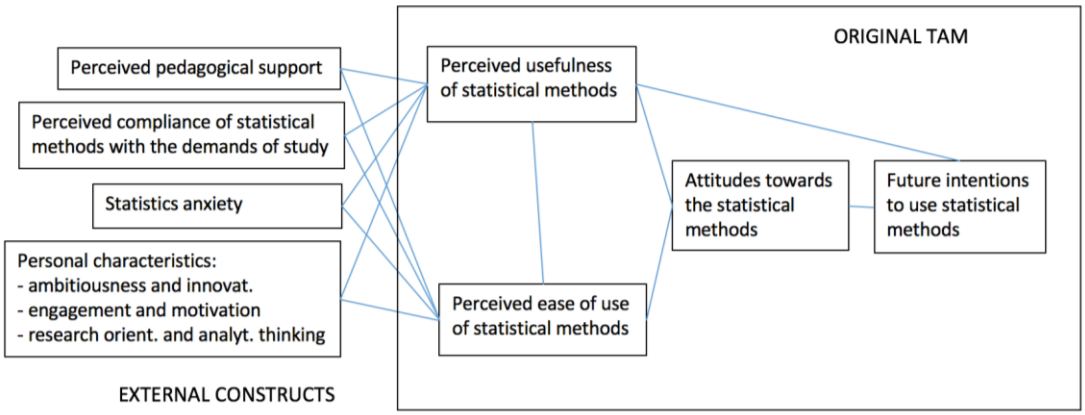

Figure 1: Research model

A questionnaire for measuring multidimensional constructs - variables of the model was employed. The items of constructs of the original TAM (perceived ease of use, perceived usefulness of statistical methods, attitudes towards statistical methods and intentions to use statistical methods

in the future), were formed based on Davis's prior studies, with modifications needed for studying the statistical methods, and based on the studies of Park (2009), Letchumanan & Muniandy (2013) and Šebjan & Tominc (2015). Additional external variables referring to the pedagogical support, statistics anxiety, perceived compliance of statistical methods with the demands of study and personal characteristics were included into the paper based on measurement scales used in the past researches and found in the literature.

Respondents were on average 23.79 years old, 27.7 % of students were males and 72.3 % females. Factor analysis was used to form the constructs and the correlation analysis was used to study the relationships among constructs obtained. Result presented here are preliminary research results, which will be further analyzed by the structural equation modelling in the future steps.

RESULTS

Results of the factor analysis are presented in Table 1, the correlation coefficients among the constructs of the original TAM in Table 2 and those with the external constructs in Table 3.

Table 1. Results of the factor analysis

Constructs	*Cronbach's Alpha*	*% of variance explained*	*KMO*	*Bartletts test app.Chi s./Sig*
Perceived usefulness	0.92	77.725	0.856	412.902 / <0.01
Perceived ease of use	0.86	72.657	0.757	214.728 / <0.01
Attitudes towards stat.	0.94	86.582	0.859	397.076 / <0.01
Future intentions	0.92	81.191	0.848	305.664 / <0.01
Support of teacher	0.83	72.358	0.753	224.384 / <0.01
Perceived compliance with study	0.86	79.306	0.723	149.201 / <0.01
Statistics anxiety	0.91	79.983	0.766	342.131 / <0.01
Ambitiousness Innovativeness	0.85	69.767	0.809	327.828 / <0.01
Engagement Motivation	0.877	64.603	0.839	476.981 / <0.01
Research orientation Analytical thinking	0.752	62.736	0.739	196.559 / <0.01
** For factor loadings of indicators, criteria higher than the value of 0.6 was used and communalities higher than 0.7.*				

Table 2. Correlation coefficients – original TAM

Constructs	1.	2.	3.
1. Perceived usefulness			
2. Perceived ease of use	0.338**		
3. Attitudes towards statistics	0.564**	0.591**	
4. Future intentions to use statistics	0.489**	0.488**	0.777**

**Significant at 0.01 level.

Table 3. Correlation coefficients – external variables

Constructs	*Perceived ease of use*	*Perceived usefulness of statistics*
Perceived usefulness	0.338**	
Teachers' support	0.290**	0.332**
Compliance with study	0.625**	0.414**
Statistics anxiety	-0.338**	-0.429**
Ambitiousness	0.440	0.032
Innovativeness	-0.001	-0.088
Engagement	0.105	0.172
Motivation	-0.003	0.205*
Analytical thinking	0.306**	0.095
Research orientation	-0.089	0.150

*Significant at 0.05 level; **Significant at 0.01 level.

CONCLUSION

Research results show, that the perceived ease of use of statistical methods is significantly positively related to the perceived usefulness of statistics and attitudes towards statistics, all of them being positively related to the future intentions of students to use statistical methods. External variables included into the model, proved to be important: perceived teachers' support and perceived compliance with the study program are significantly positively related to the perceived ease of use, as well as with the perceived usefulness of statistics. On the other hand, as expected, statistics anxiety is significantly negatively related to both of them. Personal characteristics of students proved to be only partly significant: students' motivation is positively related to the perceived usefulness of statistics and analytical thinking with the perceived ease of use of statistics.

Research results show, that the next steps of the research, using structural equation modelling, to assess the quality of the model and the relationships among constructs, are justified. If the causal effects are confirmed, our results are important for the teachers and lecturers of statistical courses. Teacher must be able to assess the motivation and engagement of students for learning as well as the self-confidence of students regarding statistics and the students' willingness to use statistics in every day's life (Gal & Ginsburg, 1994), as well as students' experiences with prior statistics and especially mathematical learning (Zhang et al. 2012).

Acknowledgment: The authors would like to thank Urban Sebjan, PhD., for his advices in the phase of drafting the objectives of this research.

REFERENCES

Davis, F. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, *38*(3), 475-487.

Dizon, G. (2016). Measuring Japanese EFL Student Perceptions of Internet-Based Tests with the Technology Acceptance Model. *The Electronic Journal for English as a Second Language, 2,* 1-17.

Fishbein, M., Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to the theory and research*. Reading, Ma.

Gal, I., & Ginsburg, L. (1994). The role of beliefs and attitudes in learning statistics: towards an assessment frame-work. *Journal of Statistics Education*, *2*(2).

Hsu, K.M., Wang, S.W., Chiu, K.K., (2009). Computer attitude, statistics anxiety and self-efficacy on statistical software adoption behavior: An empirical study of online MBA learners, *Computers in Human Behavior*, *25*(2), 412-420.

Krueger, F., Norris, A., Carsrud, I. (1993). Entrepreneurial intentions: Applying the theory of planned behavior. *Entrepreneurship and Regional Development*, 5-4.

Letchumanan, M., Muniandy, B. (2013). Migrating to e-book: a study on perceived usefulness and ease of use. *Library Hi Tech News*, *30*(7), 10-16.

Linan, F., Alain F. (2015). A systematic literature review on EI: citation, thematic analyses and research agenda. *International Entrepreneurship and Management Journal, 11*(4), 907-933.

Marjanovič Umek, L., Zupančič, M., Fekonja, U., Kavčič , T., Svetina, M., Tomazo Ravnik, T., and Bratanič, B. (2004). *Razvojna psihologija*. Ljubljana: ZR inštitut Filozofske fakultete.

Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intentions to use e-learning, *Educational Technology and Society, 12*(3), 150-162.

Sebjan, U., & Tominc, P. (2015). Impact of support of teacher and compatibility with needs of study. *Computers in Human Behavior*, *53*, 354-365.

Venkatesh, V., & Davis, F. (1996). A model of the antecedents of perceived ease of use development and test. *Decision Sciences*, *3*, 451-481.

Zhang, Y., Shang, L., Wang, R., Zhao, Q., Li, C., Xu, Y. and Su, H. (2012). Attitudes towards statistics in medical postgraduates: measuring, evaluating and monitoring, *BMC Medical Education*, *12*(117), 1-8.