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Abstract

Changes regarding the importance of graduates' competences by employers and changes of competences themselves are to a great extend driven by the technological changes, digitalization, and big data. Among these competences, the ability to perform business and data analytics, based on statistical thinking and data mining, is becoming extremely important. In this paper, we study the relationships among several constructs that are related to attitudes of economics and business students regarding quantitative statistical methods and to students' intention to use them in the future. Findings of our research provide important insights for practitioners, educators, lecturers, and curricular management teams.

Keywords: students' behavioral intentions, quantitative statistical methods

Introduction

The global changes, characterized by the digitalization of everyday life, the use of mobile devices, and the characteristics of the fourth industrial revolution, are also changing the competences that are demanded by employers when hiring new employees (World Economic Forum, 2016). The consequence of these changes

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is the high velocity, high volume, and high variety of big information assets (known as "big data") that demand cost-effective, innovative forms of information processing for enhanced insight and decision-making. In these changed circumstances, businesses today are seeking new and better ways to remain competitive, profitable, and prepared for the future; for achieving this, companies are aware of the importance of information hidden in the big data. Thus, it is not surprising that, among top competences that are the most important for employers, according to different authors, the statistical analysis and data mining ability, along with data visualization, are found within top-10 places (LinkedIn, 2016, 2018; World Economic Forum, 2018).

Our research stems from the fact that, nowadays, management in enterprises is faced with the amount of data, growing at a rapid rate, i.e., the analysis of insights of data must be used with the purpose to lead to better decisions and strategic business activities, if companies want to adapt to rapid and constant market changes. Managers in companies are often lacking detailed knowledge and understanding of data and business analytics skills, and their application in strategic and operational decision-making, which is associated with advanced statistical methods by using statistical software support.

Among the important characteristics of efficient educational institution and its study programs is the ability to continuously (re)design study programs' learning outcomes according to the demands of the labor market: moreover, higher educational institutions must have the ability to anticipate, which are going to be competences of graduates, that companies will be looking for at their future employees. The above-mentioned competence of data and business analytics skills is in the forefront of these efforts.

The aim of our paper is to shed light on the development of the ability (competence) to perform quantitative research by students. Quantitative research is to a great extent associated with statistics; statistics contents are usually included in the quantitative courses of study programs, regardless of the study cycle and the field, thus expressing the growing importance of statistical knowledge in natural, social, and physical sciences. On the other hand, students at different levels are facing difficulties in learning statistics and quantitative methods in general; it was found that students see statistics and quantitative topics in general as being more difficult than other domains, with negative attitudes often being the main obstacle (Murtonen & Lehtinen, 2010). Several studies have shown the relationship between students' attitudes toward quantitative methods and their performance as well (Mondejar-Jimenez & Vargas-Vargas, 2010; Murtonen & Lehtinen, 2010). Another characteristics of the quantitative courses including statistics is that, at least for last 20 years, the use of statistical software support is included (Biehler, 1997; Bovas, 2007). The technological development had a real impact on the statistics discipline in general and on the training of professional statisticians and users of statistics in particular.

Our research model is based on the previous researches' results utilizing the technology acceptance model (TAM) (Davis, 1986) with included external variables to the model, which were proven to be important (Šebjan & Tominc, 2015; Marjanovič Umek et al., 2004; Hsu et al., 2009; Macher et al., 2012; Krueger et al., 1993; Yousafzai et al., 2007; Linan & Alain, 2015). The main goal of our research is to test if the external factors analyzed are associated with students' perceived ease of use of quantitative methods and students' perceived usefulness of them. We assume that perceived ease of use and perceived usefulness of quantitative methods are related to the attitudes of students toward quantitative methods and their behavioral intention to use these methods in the future. Our research is not aimed at testing the TAM model but is limited to the analysis of relationships among variables of the research model, presented in the paper.

Research is based on a survey among master's degree students in economics and business who had the course of quantitative methods in their study program. The random sample was obtained with the purpose to test hypotheses formed. Multidimensional variables/constructs were formed by factor analysis. Pearson correlation coefficients were used to test the significance of relationship among constructs.

The paper is structured as follows. After the introduction, the literature review is presented. After methodology and data section, results and conclusion with discussion are presented. A plan for further research is offered as well.

Theoretical Background

Model TAM

The TAM is one of the most frequently used models for researching the usefulness of technology, program supports, and information solutions. The work of Davis (1986) may be viewed as the beginning of the development of TAM. It is based on the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975), which is built on the belief–attitude–intention–behavior relationship. This model has been further developed using the theory of planned behavior (TPB) from social psychology (Ajzen, 1991). According to this theory, behavioral intentions indicate a person's intention to carry out the specific behavior.

According to the TPB, individual's behavioral intentions are shaped by the three antecedents: attitude toward the behavior, subjective norm, and perceived behavioral control. Beliefs, attitudes, and intentions are also important factors in the adoption of computer technologies (Bagozi et al., 1998). TAM has been successfully used in the past to study different aspects of students' acceptance of technology (Sabalic & Schoener, 2017) of information communication technologies (Ali et al., 2016; Abdulah et al., 2016) and software acceptance (Antonius et al., 2015; Šebjan & Tominc, 2015; Brezavšček et al., 2017), etc.

Venkatesh and Davis (1996) summarize TAM as consisting of four main constructs that influence the behavioral intentions of future use: perceived ease of use, perceived usefulness, external variables (a group of constructs), and attitudes toward future use. Perceived usefulness is defined as the degree to which a person believes that using a particular system would improve his or her work efficiency, while 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).

The model TAM has been continuously studied and expanded. Among the models, a well known and widely used extended version is TAM 2 (Venkatesh & Davis, 2000; Venkatesh, 2000). Venkatesh et al. (2003) proposed a unified model called the unified theory of acceptance and use of technology (UTAUT), as well. UTUAT states that "Performance Expectancy which is an extension of Usefulness from TAM, Effort Expectancy which is an extension of Ease of Use from TAM, Social Influence and Facilitating Conditions are determinants of Behavioral Intention or Use Behavior, and that Gender, Age, Experience and Voluntariness of use have moderating effects on the acceptance of IT" (Terzis et al., 2012). A TAM 3 has also been proposed in the context of e-commerce with an inclusion of the effects of trust and perceived risk on system use (Venkatesh & Bala, 2008).

External factors in TAM

In the past, TAM was expanded to include several external variables; researches that were based on TAM and were analyzing different aspects of acceptance of statistical software and/or quantitative methods by students included different external technological, social, psychological, and individual and behavioral factors. Researchers who studied the use of the SPSS statistical support program have expanded the TAM model to also include components such as computer attitude, statistics anxiety, statistical software self-efficacy, statistics learning self-efficacy, statistics learning value, and satisfaction with achievements (Brezavšček et al., 2014; Hsu et al., 2009), whereby they have tied these to two key components of the TAM model: the perceived usefulness and the perceived ease of use of SPSS.

Šebjan and Tominc (2015) used the TAM model for research related to the applicability of statistical software support (SPSS program) for economics and business students. The purpose of their research was to test the importance of two external constructs, namely, pedagogical support and compliance with the study needs. Research revealed that the pedagogical support of teachers significantly contributes to the perceived ease of use of SPSS. Specifically, their findings showed that teacher support has a positive and important influence on the perceived ease of use of SPSS and a positive but insignificant effect on the perceived usefulness of the software. Other researchers have reported similar findings (e.g., Lai et al., 2012). Therefore, we assumed that a comparable relationship applies to modeling intentions about the future use of quantitative methods.

It was also found (Šebjan & Tominc, 2015) that there is a link between the perceived alignment with the field of study, the use of SPSS, and future intention to use SPSS. In other words, the perceived value of SPSS usage within one's study positively affects his/her perceived usefulness of SPSS and the perceived intention of using the software in the future (cf. Emmioğlu & Capa-Aydin, 2012).

Anxiety can also affect the ability to acquire knowledge and skills in statistics (Hsu et al., 2009; Macher et al., 2012); thus, it is possible that this variable impacts the behavioral intention to use statistics in the future. Anxiety is an undefined experience of endangerment, discomfort, or disturbance that develops out of fear and anxiety, not stemming from an existing but rather anticipated situation. It is a generalized emotional state arising from a subjective problem (Marjanovič Umek et al., 2004).

Individual personal characteristics (more widely described as "personal-level characteristics") have been identified as important antecedents of certain behavioral intentions as well (Krueger et al., 1993; Yousafzai et al., 2007; Linan & Alain, 2015).

Research Model and Hypotheses

Our research model is based on the results of previous researches utilizing the TAM model and its extensions, which are described in the previous chapter. As already mentioned, the aim of this paper is not to test dependencies among constructs of extended TAM but to study the relationships among multidimensional variables/constructs

included into the research model: perceived ease of use of quantitative methods, perceived usefulness of quantitative methods, perceived attitudes toward quantitative methods, and behavioral intentions to use quantitative methods in the future. Based on the research results and arguments, as presented in the literature review, the external variables that are also included into our model are (a) pedagogical support in the study process; (b) perceived alignment of statistical methods with the level of study; (c) statistics anxiety and personal characteristics of individuals; and three variables for personal characteristics, namely (d) ambition and innovativeness; (e) engagement and motivation; and (f) research orientation and analytical thinking.

The research model with the relationships among multidimensional variables is summarized in Figure 1.

Hypotheses of the model are formed with the purpose to test relationship among multidimensional variables:

H1: The correlation between perceived pedagogical support and perceived usefulness of quantitative methods is significant and positive.

H2: The correlation between perceived pedagogical support and the perceived ease of use of quantitative methods is significant and positive.

H3: The correlation between perceived alignment of quantitative methods with the demands of the study program and perceived usefulness of quantitative methods is significant and positive.

H4: The correlation between perceived alignment of quantitative methods with the demands of study program and the perceived ease of use of quantitative methods is significant and positive.

H5: The correlation between statistics anxiety and the perceived usefulness of quantitative methods is significant and negative.

H6: The correlation between statistics anxiety and the perceived ease of use of quantitative methods is significant and negative.

H7,i: The correlation between *i*-th personal characteristics and the perceived usefulness of quantitative methods is significant and positive; *i*=1,2,3.

H8,i: The correlation between *i*-th personal characteristics and the perceived ease of use of quantitative methods is significant and positive; *i*=1,2,3.

H9: The correlation between perceived ease of use of quantitative methods and their perceived usefulness is significant and positive.

H10: The correlation between usefulness of quantitative methods and students' attitudes towards them is significant and positive.

H11: The correlation between perceived ease of use of quantitative methods and and students' attitudes towards them is significant and positive.

H12: The correlation between usefulness of quantitative methods and students' intentions to use them in the future is significant and positive.

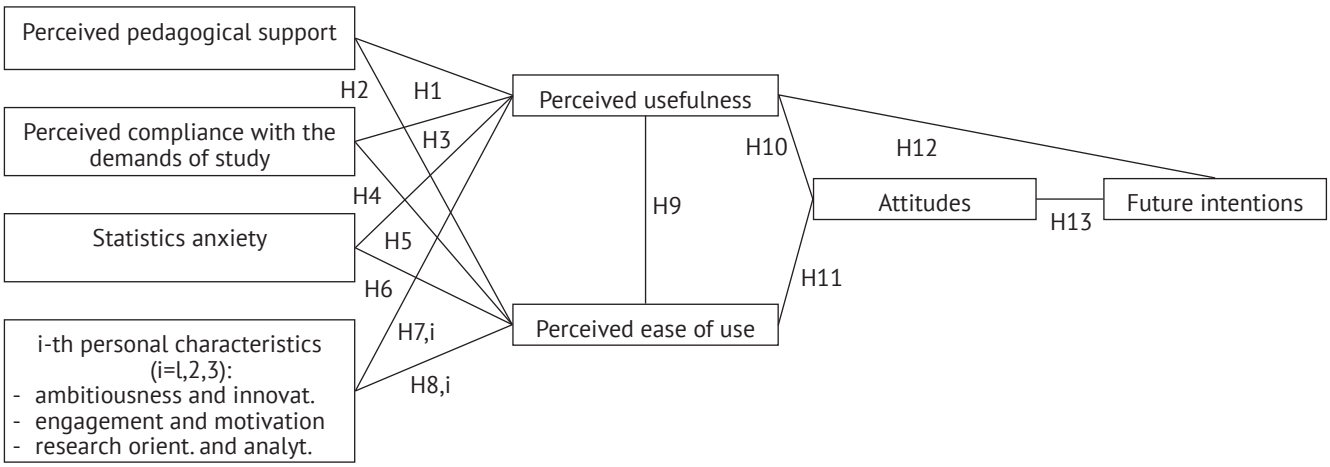
H13: The correlation between students' attitudes towards quantitative methods and students' intentions to use them in the future is significant and positive.

Methodology and Data

The survey was conducted among students (full- and part-time) of the master cycle study program Economics and Business at University of Maribor, Faculty of Economics and Business, in January 2017 (*n*=101).

All variables included in the model presented by Figure 1 are multidimensional variables/constructs. A questionnaire

Figure 1. Research Model



(Source: Authors)

for measuring multidimensional variables of the model was employed. Items of the constructs' perceived ease of use, perceived usefulness of statistical methods, attitudes toward statistical methods, and intentions to use statistical methods in the future were formed based on Davis's prior studies (Davis et al., 1989), with slight wording modifications made for studying quantitative methods (cf. Park, 2009; Letchumanan & Muniandy, 2013; Šebjan & Tominc, 2015). Items of constructs referring to the pedagogical support, statistics anxiety, perceived alignment of quantitative methods with the demands of study and personal characteristics were included in the paper based on Arthur and Yuet Wong (2000); Pierce, Stacey, and Barkatsas (2007); Ameen and Loeffler-Cobia (2010); Vos, van der Meijden, and Denessen (2011); and Nikou and Economides (2016). In the questionnaire, each multidimensional variable was expressed by several statements/items, i.e., students assessed the level of agreement with each statement, from 1 (completely do not agree) to 5 (completely agree).

To establish the structure of the multidimensional variables/constructs of the research model, factor analysis was used. Bartlett's test of sphericity (BTS), applying the 0.05 significance level and Kaiser–Meyer–Olkin statistics (KMO), applying the treshold > 0.7 (Field, 2009), were calculated. In the case of more than one factor, a simpler factor structure was obtained using the principal component analysis (PCA) and the Varimax rotation. The criteria that factor loadings of each variable must exceed 0.5 were used to guarantee the reliability and validity of the questionnaire scales (Nunnally, 1978).

Correlation analysis was used to test hypotheses regarding the relationships among multidimensional variables, using the 0.05 significance level.

Structure of the sample is presented in Table 1. Respondents averaged 23.79 years old with 27.7% of students being male and 72.3% being female.

Table 1. Structure of the Sample Regarding Age and Gender

Sample Structure		f%
Gender	Male	27.7
	Female	72.3
Age	21 – 22 years	29.7
	23 – 24 years	49.5
	25 – 26 years	12.8
	27 – 28 years	3.0
	29 and older	5.0

Results

In the first stage of the analysis, the factor analysis was used to obtain the multidimensional variables of the model. Results of the factor analysis are presented in Table 2, where, for all constructs of the research, single factor solutions were obtained, except for the *i*-th personal characteristics, (i = 1, 2, 3) of students, where the two factors solutions were obtained.

Cronbach's alpha coefficients confirm the reliability of the measurement scales for each construct, while KMO statistics and the significance of Bartlett's test for each multidimensional construct confirms that using factor analysis is justified.

Multidimensional variables, i.e., factors obtained, explain the high percentage of the variance of original variables

Table 2. Results of the Factor Analysis for Multidimensional Variables of the Research Model

Constructs of the research model	Cronbach's Alpha	% of Variance Explained	KMO	Bartletts Test X2 / Sig.
Perceived usefulness of quantitative methods	0.92	77.725	0.856	412.902 / <0.01
Perceived ease of use of quantitative methods	0.86	72.657	0.757	214.728 / <0.01
Attitude toward quantitative methods	0.94	86.582	0.859	397.076 / <0.01
Future intention to use quantitative methods	0.92	81.191	0.848	305.664 / <0.01
Perceived pedagogical support	0.83	72.358	0.753	224.384 / <0.01
Perceived alignment with study	0.86	79.306	0.723	149.201 / <0.01
Statistics anxiety	0.91	79.983	0.766	342.131 / <0.01
Personal characteristics				
Ambition	0.85	69.767	0.809	327.828 / <0.01
Innovativeness				
Engagement	0.877	64.603	0.839	476.981 / <0.01
Motivation				
Research orientation	0.752	62.736	0.739	196.559 / <0.01
Analytical thinking				

(items in the questionnaire); for all factors, the percentage of variances explained is higher than 60%.

In the second stage of research hypotheses, H1–H13 were tested.

Table 3. Results for Hypotheses Testing

Hypotheses	Correlation Coefficients
H1: Perceived pedagogical support; Perceived usefulness	0.332**
H2: Perceived pedagogical support; Perceived ease of use	0.290**
H3: Perceived alignment with study; Perceived usefulness	0.414**
H4: Perceived alignment with study; Perceived ease of use	0.625**
H5: Statistics anxiety; Perceived usefulness	-0.429**
H6: Statistics anxiety; Perceived ease of use	-0.338**
H7,1: Ambition; Perceived usefulness Innovativeness; Perceived usefulness	0.032 -0.008
H7,2: Engagement; Perceived usefulness Motivation; Perceived usefulness	0.172 0.205*
H7,3: Analytical thinking; Perceived usefulness Research orientation; Perceived usefulness	0.095 0.150
H8,1: Ambition; Perceived ease of use Innovativeness; Perceived ease of use	0.440 -0.001
H8,2: Engagement; Perceived ease of use Motivation; Perceived ease of use	0.105 -0.003
H8,3: Analytical thinking; Perceived ease of use Research orientation; Perceived ease of use	0.306** -0.089
H9: Perceived ease of use; Perceived usefulness	0.338**
H10: Perceived usefulness; Attitudes	0.564**
H11: Perceived ease of use; Attitudes	0.591**
H12: Perceived usefulness; Intentions	0.489**
H13: Attitudes; Intentions	0.777**

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

Several statistically significant correlations were found. Perceived pedagogical support is positively related to perceived ease of use and perceived usefulness of quantitative methods, thus confirming H1 and H2. The same is true when students perceive quantitative methods as aligned with their study program's content and objectives, thus confirming H3 and H4.

Statistics anxiety is significantly negatively related to perceived ease of use and usefulness of quantitative methods, thus confirming H5 and H6, as well.

Among students' personal characteristics, the motivation of students was significantly and positively related to perceived usefulness of quantitative methods, thus partly confirming H7,1. Analytical thinking was significantly and positively related to the perceived ease of use of quantitative methods, as expected, thus partly confirming H8,3. Other relationships between personal characteristics and perceived ease of use, as well as with the perceived usefulness of quantitative methods, are not significant. Hypotheses H7,2; H7,3; H8,1; and H8,2 were rejected.

Students who perceive quantitative methods as easy to use generally perceive that quantitative methods are useful as well. Perceived ease of use and perceived usefulness of quantitative methods are significantly and positively related to positive attitudes toward them. Those with more positive attitudes toward quantitative methods, on average, intend to use quantitative methods in the future to a greater extent, which holds true for the perceived usefulness, as well. Therefore, the hypotheses H9, H10, H11, H12 and H13 are confirmed.

Conclusions

This research brings important information for practitioners, e.g., educators, lecturers, and curricula management teams. Because the importance of statistical knowledge and broader quantitative methods in business and industry has been recognized, graduates have to be equipped with the relevant statistical knowledge before entering the work place. This relevant knowledge and its practical value include the ability to handle massive data sets, where use of statistical software to perform statistical analyses is vital. Efforts to influence positive attitudes may include several counselling activities, encouragement of positive attitudes toward this knowledge by lecturers, case studies, etc. Our research has important implications for higher educational institutions that want to equip their graduates with the competences of conducting quantitative research methods and to enhance their intentions to use these methods in the future.

Teachers of quantitative statistical courses often believe that the majority of students share negative opinions about statistics during and prior to matriculating into the course. Indeed, students often develop negative attitudes toward quantitative methods and statistics and often see the statistical course as an obstacle in their path to graduation. Research results, as listed in the literature, show that a fear

of statistics is often associated with the students' lack of interest in using statistics and quantitative methods, and their perception that competence in conducting quantitative research is relatively unimportant in employability compared with other competences (e.g., communication skills, critical thinking, etc.) (Chamberlain et al., 2015). Differences exist in the effect sizes of these relationships across different fields and across countries (Emmioğlu & Capa-Aydin, 2012).

This research suggests that reinforcing the value of quantitative statistical methods for academic programs and in a professional career may be associated with a higher students' intention to use them. It is suggested that the quantitative methods are included into certain academic subjects' research projects where students participate, so that students will have more analytical work with the collection and processing of data, which they therefore learn in the context of their respective study programs.

Researchers have also pointed out that student attitudes toward statistics are often based on students' previous experiences with statistical and mathematical courses (Zhang et al., 2012). Some authors argue that the key factor for negative attitudes toward statistics and for statistical anxiety is the mathematical background of the student. Students, who are worried about a statistics course often feel that that they are not good enough in mathematics and often this harkens back to experiences in primary or secondary education. Teachers should be aware of this problem and should introduce a quantitative statistics course at the beginning of studies and illustrate the difference between quantitative statistics and mathematics (Chamberlain et al., 2015), especially because statistics in management and business studies largely is about information and the interpretation of data rather than mathematical proofs.

Results presented here are preliminary, and several extensions of our research are possible. The next steps in research could be to use structural equation modelling to assess the dependencies among constructs. If the causal effects are confirmed, our results will provide additional insight for teachers of statistical courses.

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Pričakovane namere študentov glede prihodnje uporabe kvantitativnih metod

Izvleček

Spremembe, povezane s pomenom kompetenc diplomantov za delodajalce, in spremembe kompetenc samih so v veliki meri posledica tehnoloških sprememb, digitalizacije in pojava velikih podatkov. Med temi kompetencami postajajo izjemno pomembne sposobnosti opravljanja poslovne in podatkovne analitike, ki temelji na statističnem razmišljanju in podatkovnem rudarjenju. V tem članku proučujemo odnose med več konstrukti, ki so povezani z odnosom študentov ekonomskih in poslovnih ved do kvantitativnih statističnih metod in njihovimi nameni, da jih bodo uporabljali v prihodnosti. Ugotovitve naše raziskave prinašajo pomembne vpoglede za strokovnjake, pedagoge, predavatelje in oblikovalce kurikuluma.

Ključne besede: pričakovane namere študentov, kvantitativne statistične metode