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DETERMINANTS OF LEARNING OUTCOMES AND SATISFACTION WITH ONLINE TEACHING BASED ON STUDENTS' PERCEPTION - SUITABILITY OF APPLYING THE INSTRUMENT

Abstract: Research on perceived learning outcomes and student satisfaction with online university education, as well as defining determinants of critical success factors in online teaching, is on the rise. Determining the key success factors, i.e. determinants of online teaching success, is extremely important, especially now that all higher education institutions have been forced to try their hand at teaching through technology (TBL – technology-based learning). The research presented in this paper was conducted on a sample of 360 students of the University of Novi Sad at different levels and types of studies, using the PLS structural equation modelling. A questionnaire that is a synthesis of Virtual Learning Environment models and Learning Frameworks through techniques was applied. The motivation for the research was to prove that the same instrument can be applied in Serbia, i.e. on data collected from students at the University of Novi Sad. The following were selected as dependent variables: learning outcomes and student satisfaction with teaching. Independent variables were presented with constructs: intrinsic and extrinsic motivation, dialogue and cooperation between students, but also student-lecturer, course design, and student self-regulation during learning, and were observed as potential determinants of online learning outcomes in terms of user satisfaction and learning outcomes. After data processing, the applied instrument proved to be extremely suitable and useful. The research presented in this paper is among the first ones done on the topic of success of the online lectures during the pandemic in Serbia.

Keywords: Success Factors, Online Teaching, Learning Outcomes, Student Satisfaction

1. THEORETICAL FRAMEWORK

The environment in which knowledge and skills are acquired is changing quickly. Although distance learning has grown since 2000, providing access to modern materials, knowledge and remote experts, teaching was limited by the language in which the teaching was conducted (English, Chinese, etc.). In recent years online learning is growing at an incredible rate (Kauffman, H., 2015). Two years ago, the environment in which classes had to be conducted had a significant impact on lecturers, universities, and students themselves who had to adapt to the new situation and research is scarcely available (Gopal et al. 2021; Mo et al. 2021). This drastic change has forced all higher education institutions to try their hand at distance learning systems.

The distance learning system can be defined as the interaction of human and non-human entities that interact through an instructional system that includes a platform for collaboration and use of technology as a mediator of knowledge exchange, all in order to acquire skills and knowledge - learning outcomes, and user satisfaction (Eom, B. & Ashill, N., 2016). Learning outcomes (Kauffman, H., 2015; Kwok, D. 2015) and user satisfaction (Eom et al. 2006) are mainly cited as a measure of the success of distance learning.

By defining the basic characteristic of e-learning as constructing knowledge, we clearly opt for the constructivist model, which implies that knowledge is created, as opposed to the objectivist or behaviorist model. (Piaget, J., 1977, Wang et al. 2021). Models that rely on or derive from the constructivist model are: collaboration, socioculturalism, cognitive information processing model, discovery learning and facilitated learning (Eom, B. & Ashill, N., 2016). A common feature of all these models is that knowledge is created through e-learning, but they don't agree on how the knowledge is best constructed (from the ultimate individualism of the student, to collectivism). The paper is based on a constructivist assumption, and a systematic overview of the basic assumptions and implications is presented in Picture 1.
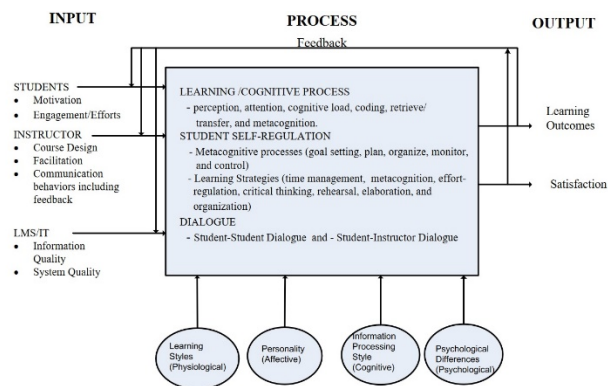
Picture 1: System's view of e-learning system
Source: Eom, B. and Ashill, N. 2018. p.189

According to this system, e-learning is an open system with three entities (students, instructor and learning management system (LMS)) that are in constant interaction with each other and with the environment to optimize output in the form of learning outcomes and satisfaction. The system is derived from the Virtual learning environment (VLE) effectiveness model of Piccoli et al 2001. Linking the presented system with the framework of technology-based learning (TBL) (Loderer et al., 2020) an instrument was created that was applied to the student perception (Alavi, M. & Leidner, D. E. 2001). Research was conducted in the Midwestern United States (Eom, B. & Ashill, N., 2016), which inspired the research presented in this paper.

2. FACTORS CONTRIBUTING TO THE SUCCESS OF ONLINE TEACHING

Change of the learning environment from face-to-face to distance learning (Panigrahi et al. 2021), saddles students (Stevens et al. 2021) with a great deal of responsibility and need to better organize and motivate themselves, due to change from the role of passive learners to active learners. Self-motivation is a psychological construct and can be defined as generating energy that directs behavior toward a specific goal (Zimmerman, B. J. 2008). Student characteristics that have a significant impact on learning outcomes and satisfaction count as more than 30 attributes. These include: previous experience with e-learning, experience with computer use, self-efficacy, learning style, motivation (Schoor, C. & Bannert, M., 2011), metacognition (Prins et al, 2006), and learning engagement. The focus of this paper is on: motivation, self-regulated learning including metacognition, and learning engagement.

Self-motivation could be defined as intrinsic, as a psychological characteristic due to which an individual carries out activities that will lead him to personal satisfaction (Vrieling-Teunter et al. 2021). On the other hand, extrinsic motivation is a psychological characteristic due to which an individual will undertake activities that will enable him to achieve a separable outcome such as a reward or recognition. These two types of motivation are also two measuring instruments that are suitable for explaining self-motivation.

The basic premise of the constructivist school of learning is that one learns best when things are discovered in one's own time and at one's own pace. Following this assumption, it is clear that students who are self-regulated and independent will achieve better success in the online learning environment. Students who are self-regulated can be said to be "metacognitively, motivationally, and behaviorally active participants in their own learning process" (Zimmerman, B. J. 2008). These type of students take the initiative to start and conduct their studies, coordinate their engagement and don't wait for lecturers, parents or some other agents to initiate and lead them.

Unlike face-to-face classes, which rely on lectures as the basic method of learning, collaborativism assumes that knowledge is constructed socially by collaboration through groups' shared understanding via different models of knowledge discovery such as: social collaborative learning, interactive, and discovery learning (Saghafian, M. &

O'Neill, D. K. 2018). The term dialogue is used to describe the essential, constructive, and meaningful interaction that each group member values. Dialogue promotes learning through active participation and enables deep cognitive engagement with the aim of developing higher level knowledge.

Course Design is part of the formal role of the instructor, which represents the rigidity or flexibility of the education goals, teaching strategy, and assessment methods (Kim et al. 2021). It also describes the range in which the program can cover and respond to all student requests. The basic categories that describe and can improve course design are: course overview and introduction, learning objectives, assessment and measurement, and instructional materials.

3. RESEARCH METHODOLOGY

3.1. Instrument

For this research, we used the Survey Instrument, which was carefully developed and implemented (Eom, S.B, & Ashill, N. 2016; Eom, S.B, & Ashill, N. 2018). The basis of the instrument is commonly administered IDEA (Individual Development and Educational Assessment) student rating system from Kansas State University and the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al. 1993). The instrument itself consists of 8 sections. The first includes general information about the respondents, such as: age, gender, faculty, types of studies, level of studies and experience with distance learning. The other sections are dedicated to the constructs: Student Motivation; Student - Student Dialogue; Instructor - Student Dialogue; Course Design; Self-Regulation; Learning Outcomes; User Satisfaction. Questions are presented in Table 1, which provides results of the analysis. The questionnaire consisted of assertions written in the form of statements with the possibility of different answers in the form of a five point Likert type scale (5=completely agree, 4=agree, 3=neither agree nor disagree, 2=disagree, 1=completely disagree). This scale allows for a precise determination of the respondent's attitude towards statements.

3.2. Sample

Over the course of data collection, multiple available methods of communication with students in the environment of online teaching were used. Most students were contacted via previously formed teams on the MS Teams learning platform, but also via a database of student contacts on the Moodle platform. In total, we contacted over 2,500 students of the University of Novi Sad enrolled at either the Faculty of Technical Sciences, or the Faculty of Economics in Subotica. During the one-month student survey, 360 valid and complete answers were collected. Response rate is about 14%, which is acceptable for this type of survey. The dominant profile among the respondents is an undergraduate student, 18 to 22 years of age, female, with sufficient experience in distance learning. Characteristics of the sample on which the data processing was performed are presented in the form (frequency; percent) and are presented in Picture 2:
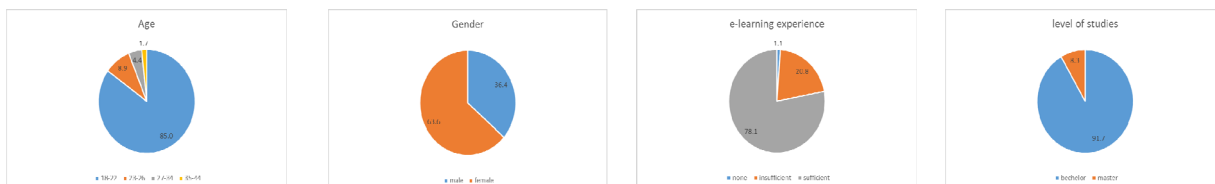
Picture 2: Demographic characteristics of survey respondents
Source: Authors

- Age: 18-22 (306; 85%); 23-26 (32; 8.9%); 27-34 (16; 4.4%) and 35-44 (6; 1.7%)
- Sex: male (131; 36.4%), female (229; 63.6%)
- Faculty: FTN (213; 59.2), EFSU (147; 40.8%)
- Type of studies: professional (35; 9.7%), academic (325; 90.3%)
- Level of studies: bachelor (330; 91.7%), master (30; 8.3%)
- Distance learning experience: none (4; 1.1%), insufficient (75; 20.8%), sufficient (281; 78.1%)

4. RESEARCH RESULTS

The instrument was applied to a sample of 360 respondents using the PLS structural equation modelling methodology for two reasons. The first one is that PLS is suitable for application in the early stages of development of theory and testing, and the second and more important one is that it is particularly suitable for examining the attitudes of respondents.

The first step of data processing involved estimating the model and checking its reliability. The composite reliability of the group of indicators that measure the construct was done on the basis of the Composite Reliability (CR) and Average Variance Extracted (AVE) indices. Internal consistency was confirmed in all constructs as measured by both indicators.

If we take into account the Composite Reliability indicator, which represents the internal consistency of the test, i.e. the degree to which all test items covariate with each other, with a limit of 0.7 as acceptable in Table 1. It is noticeable that for each construct the value of this indicator is in the range of 0.8 to 0.961. The application of this indicator is more frequent for Confirmatory Factor Analysis (CFA), as opposed to Crombach's Alpha, which is more appropriate for Exploratory Factor Analysis (EFA). The Average Variance Extracted is in the range of 0.576 to 0.861, which is considered acceptable, i.e. more variance is covered by the construct than the measurement error. The results are shown in Table 1.

Table 1: Convergent and discriminant validity of the model constructs

Construct and Items	Loading
Intrinsic Student Motivation (CR=0.800; AVE 0.576)	
SMI 1 - When learning online, I prefer study material that encourages me to learn new things.	**0.869**
SMI 2 - When I have the opportunity to choose assignments in an online class, I choose assignments from which I can learn even if they do not guarantee a good grade.	0.633
SMI 3 - I do everything I can to complete my tasks perfectly.	**0.757**
Extrinsic Student Motivation (CR=0.782; AVE 0.650)	
SME 1 - I work hard to get a good grade even if I don't like the subject.	**0.926**
SME 2 - I want to get a good grade because it is important for me to demonstrate my abilities to my family, parents or other people.	0.656
Student – Student Dialogue (CR=0.868; AVE 0.624)	
DS 1 - I often had positive and constructive interactions with other students while learning online.	0.681
DS 2 - During online learning, the level of positive and constructive interaction between students was high.	**0.809**
DS 3 - I learned more in the classes I attended remotely (online) than in the classes I attended live (offline).	**0.815**
DS 4 - Positive and constructive interactions between students during distance learning have helped me improve the quality of learning outcomes.	**0.845**
Instructor – Student Dialogue (CR=0.930; AVE 0.77)	
DI 1 - During distance learning, I often had positive and constructive interactions with the lecturer.	**0.895**
DI 2 - The level of positive and constructive interaction between lecturers and students was high during distance learning.	**0.912**
DI 3 - Positive and constructive interactions between lecturers and students during distance learning have helped me to improve the quality of learning outcomes.	**0.903**
DI 4 - Positive and constructive interaction between students and lecturers was an important component of learning.	**0.795**
Course Design (CR=0.902; AVE 0.648)	
C 1 - The objectives and procedures of the online course are clearly stated.	**0.822**
C 2 - The structure of the sections of the online course was well organized into logical and understandable components.	**0.858**
C 3 - The materials for the online subjects were interesting and stimulated my desire to learn.	**0.817**
C 4 - Online course materials have provided me with an effective set of challenges.	**0.773**
C 5 - Student assessment components such as assignments, projects, and exams were related to classroom learning objectives.	**0.752**
Self-Regulation (CR=0.876; AVE 0.639)	
SR 1 - In the beginning, I set my goals and planned in accordance with what I needed to do in order to achieve the desired learning outcomes.	**0.826**
SR 2 - Even when learning materials are boring and uninteresting, I work until I'm done.	**0.79**
SR 3 - I pay attention my grades in each subject and if I seem to be lagging behind in one subject, I dedicate more time to it during my studies.	**0.792**
SR 4 - When I study for a test, I try to combine information from class notes and from textbook.	**0.788**
Learning Outcomes (CR=0.961; AVE 0.861)	
LO 1 - The quality of the online lectures is on a par with the lectures I attended live.	**0.911**
LO 2 - I learned as much from online lectures as I would have learned if I had attended those lectures live.	**0.925**
LO 3 - I learn more in online classes than in live classes.	**0.934**
LO 4 - The quality of the learning experience in online classes is better than in live classes.	**0.941**
User Satisfaction (CR=0.939; AVE 0.795)	
US 1 - I would recommend professors who give lectures online to other students.	**0.79**
US 2 - I would recommend online lectures to other students.	**0.918**
US 3 - In the future, I would attend online courses at this faculty again.	**0.924**
US 4 - I was very pleased with the online class.	**0.927**

Source: Authors

Analyzing convergent validity, which is reflected in loadings > 0.50 on their associated factor, in the second construct there was item SME 3 – "I like to be one of the most recognized students in the group" with a loading of 0.4 which eliminated that item from the analysis. Individual reflective measures are considered to be reliable if they correlate more than 0.6 with the construct they intend to measure. The loadings higher than 0.7 are considered to be more reliable and are dominantly present in all but first two constructs, as could be seen in Table 1.

Overall, the revised measurement model results provided support for the reliability and convergent and discriminant validities of the measures used in the study.

In determining the predictive power of the model percentage of variance explained for both dependent variables was determined in the form of R2 statistics. For the primary dependent variable in the learning outcomes construct 50.6% of variance is explained, while 58.9% variance is explained in the user satisfaction construct. The high percentage of variance explained implies satisfactory and substantive value and predictive power of the model.

5. CONCLUSION

The results of the presented research are important from the aspect of contributing to the literature dedicated to identifying the key success factors of online learning. Additional contribution refers to the research conducted in Serbia, i.e. at the University of Novi Sad. Based on the analysis of the data, it is clear that the instrument used has ideally adapted to the data which indicates its suitability and universality. Adjustment of the instrument was not necessary in any aspect. The statistical analysis led to the revised measurement model, which results provided support for the reliability and convergent and discriminant validities of the measures used in the study. For the primary dependent variable in the learning outcomes construct 50.6% of variance is explained, while 58.9% variance is explained in the user satisfaction construct. The high percentage of variance explained implies satisfactory and substantive value and predictive power of the model.

The results of this study have significant implications for lecturers. It is clear that the role of the lecturer, and course design are the cornerstones of the university online education. Improving the skills and knowledge of lecturers in the areas of: course structure preparation, discussions and interactions, technological solutions for collaboration during lectures or other types of student engagement, as well as motivation methods; would significantly affect the target variables - learning outcomes and user satisfaction.

One area for further research remains a more detailed analysis of the model itself and the possibility of finding the interdependence of constructs that affect perceived learning outcomes and user satisfaction.

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