Measuring the Impact of Online Learning on Students' Satisfaction and Student Outcomes Using Integrated Model

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Abstract – the COVID-19 pandemic has forced the universities to close face-to-face (f2f) education and move all activities online. Online learning has become essential for students to continue their education. But the shift from traditional f2f to online learning, has raised some questions about the quality and success of the learning process. This study developed an integrated model based on both the TAM and ISS model which is best suited for investigating the impact of online learning systems on students' satisfaction and student outcomes. The results showed that good system quality and information quality will motivate the students to use the online learning system more actively. On the other hand, the system should be ease of use, and students should perceive it as useful for fulfilling their tasks. Such system will provide high level of satisfaction for students, which in turn will lead to positive student outcomes.

I. INTRODUCTION

The Covid-19 pandemic has raised significant challenges for the education community worldwide. The unexpected closure of educational institutions disrupted teaching and learning activities, which were usually carried out in a direct meeting, and caused a shift of these activities online.

Online learning has become essential in this period, in order to continue the teaching and learning processes. Online learning refers to the type of learning that people take a professional or educational course using web-based technologies [1]. Online learning also refers to the delivery of educational material via any electronic media such as the internet, intranet, extranets, satellite broadcast, audio/video materials, video conferencing and computer-based training. In the context of higher education, the phrase "online learning is often interpreted as referencing courses that are offered completely online" [2].

Flexibility regarding independence of time, place and pace is one of the positive aspects of online learning [3, 4, 5, 6, 7]. The accessibility, affordability, learning pedagogy, life-long learning and policy are other arguments related to online learning. Online learning is primarily aimed to foster students to be independent at certain times and take responsibility for their learning. Besides, it allows students to play a more active role in their learning because it focuses on personalization, which includes the ability to adapt to the level of learners' skills and collecting knowledge resources as mutual support. Also, students' adaptive attitude can provide space and flexibility in regulating themselves, which might lead to success and achievement in learning.

However, the "shift" from traditional face-to-face to online learning has raised some questions about the quality of learning process as well as students' satisfaction and student outcomes [8]. Despite the notable examples of utilization of online learning in teaching and learning, its impact on user satisfaction and learning outcomes remain difficult to predict and measure [9, 10]. Limited research has been conducted on learning outcomes for university students, when practicing online learning. Therefore, an investigation of the determinants of students' satisfaction and student outcomes is significant to do.

This study tries to investigate the effect of various factors toward students' satisfaction and

student outcomes. The acceptance-success model approach was chosen as a solution to this research problem. We have applied and integrated model composed of Technology Acceptance Model (TAM) and Information System Success (ISS) to explore student outcomes in the context of online learning.

II. BACKGROUND

A. TAM

The Technology Acceptance Model (TAM) proposed by Davis and Bagozzi [11] is the most widely used innovation adoption model. It has been extensively tested and validated empirically by scholars in various fields and contexts to explore the factors affecting individual's use of new technology [12]. Based on the Theory of Reasoned Action (TRA) [13] and the Theory of Planned Behavior (TPB) [14], the TAM model use perceived usefulness and perceived ease of use to determine an actual use of the system, through the individual's attitudes towards using the system and behavioral intention of use. The system acceptance process is determined by 5 constructs:

• Perceived usefulness (PU) - is "defined as the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" [15].

• Perceived ease of use (PEOU) - "refers to the degree to which the prospective user expects the target system to be free of effort" [15].

• Attitude towards use (ATU) - it designates "an individual's positive or negative feelings (evaluative affect) about performing the target behavior" [15].

• Behavioral intention (BI) - is conceived as "a measure of the strength of one's intention to perform a specified behavior", in this case the use of the information system [15].

• Actual use (AU) - is the level of actual use of the information system.

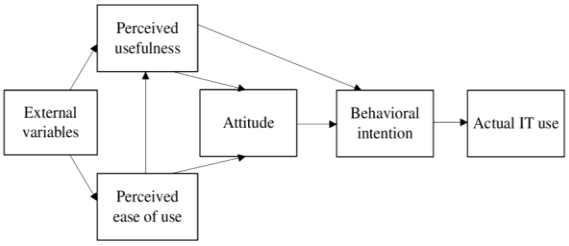

Fig. 1. Technology Acceptance Model - TAM

Recent research established that ATU is a weak mediator between PEOU, PU, and ITU [12]. Also, PU and PEOU are hypothesized to be the fundamental determinants of user acceptance, a notion verified through empirical support [16].

B. ISS

The Information System (IS) Success model is among the most influential models in both predicting and explaining system use and user satisfaction [17, 18]. This model theoretically supports the associations between determinants-satisfaction-behavior-outcomes of a system usage [19]. The original IS success model [20] consists of 6 constructs: System quality, Information quality, Use, User satisfaction, Individual impact and Organizational impact. In response to the progresses in IS applications, DeLone and McLean refined their original model and proposed an updated version in 2003 [21]. Service quality was added into the success model, and the individual impact and organizational impact were combined into a single variable named Net Benefits, as shown in Figure 2.

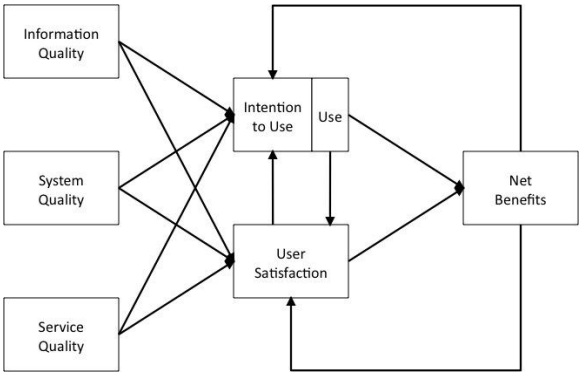

Fig. 2. Updated IS success model

• Information quality (IQ) - refers to the quality of the information that systems produce. When used with online learning systems this construct utilizes accuracy, completeness, relevance, content needs, and timeliness. We can say that IQ is the output of the system that meets user needs.

• System quality (SysQ) – is degree to which a system meets expectations. The characteristics of an online learning system that contribute to its system quality include user friendliness, availability, ease of learning, response time etc.

• Service quality (SerQ) – refers to the quality of the service or support that users receive from the IS organization and IT support personnel.

• System Use/Intention to use (SysUse) - represents the degree and manner in which an IS is utilized by its users.

• User satisfaction (US) - is considered as one of the most important measures of IS success. US represents the user's level of satisfaction when utilizing an information system. Measuring user satisfaction becomes especially useful, when the use of an IS is mandatory.

• Net Benefits (NetB) – is the extent to which information system are contributing to the success of individuals, groups, organizations and industries.

C. Students' satisfaction and student outcomes

User satisfaction is defined as user's subjective assessment of the found information, compared to the expected information that exceeds the evaluation of internal standards. It is considered as one of the most important measures of IS success. Measuring user satisfaction becomes especially useful, when the use of an IS is mandatory. In this study we will measure students' satisfaction (SS), when using the online learning system.

Student outcomes (SO) are descriptions of the abilities, skills and knowledge that are used for assessing student learning. Student outcomes should outline what students have learned and what they can demonstrate upon completion of a course. Various approaches in the current literature exist for measuring student outcomes. In our study we used grades as an assessment of individual students' performance.

III. RESEARCH MODEL AND HYPOTHESES

Based on the theoretical support from IS success model and TAM researches, we have decided to use an integrated research model to determine the impact of online learning on student outcomes (Figure 3.). This study examines relationships among IQ, SysQ, PEUO, PU, SysUse, SS and SO in an online learning environment based on the TAM and ISS model. Accordingly, the following research hypotheses were proposed:

H1: Information quality will positively contribute to system use.

H2: Information quality will positively contribute to higher students' satisfaction.

H3: System quality will positively contribute to system use.

H4: System quality will positively contribute to higher students' satisfaction.

H5: Perceive ease of use will positively contribute to system use.

H6: Perceive ease of use will positively contribute to higher students' satisfaction.

H7: Perceive ease of use will positively contribute to perceive usefulness.

H8: Perceive usefulness will positively contribute to system use.

H9: Perceive usefulness will positively contribute to higher students' satisfaction.

H10: System use will positively contribute to higher students' satisfaction.

H11: Students' satisfaction will positively contribute to student outcome.

The research model of the present study and the hypotheses are illustrated in Fig.3.

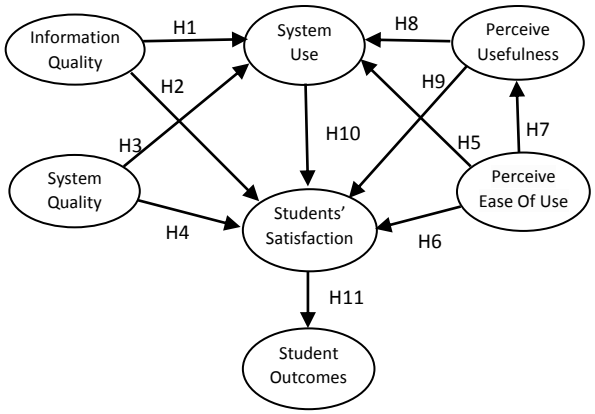

Fig.3. Research model

IV. RESEARCH METHOD

A. Context

This study was carried out at the University "Goce Delcev" – Stip, In Republic of North Macedonia. The distribution of learning materials, as well as the interaction and collaboration between students and teachers, was performed via Moodle LMS. Students were also encouraged to use communication tools such as forum and chat to support their educational interaction with other colleagues. The online teaching activities were carried out using Microsoft Teams videoconferencing application. Exams were also taken online, due to the pandemic, in order to avoid any physical contact.

B. Measurement instrument

A mixed-methods survey research design was employed. The survey research design was appropriate for this study, because it aims to reveal the causal relationship between the identified constructs. All survey items used a 5-point Likert scale ranging from 1 "strongly disagree" to 5 "strongly agree." The grades from final exam range from 5 to 10.

C. Participants

This study targeted undergraduate computer science students who attended several online courses, during the summer semester of academic year 2019-2020. The average age of the participants was 21, and 65% of them were female. In total, 80 valid questionnaires with valid data were collected and included in the analyses.

V. DATA ANALYSES

Path analysis was carried out to test the hypothesis. Structural equation modeling (SEM) by SmartPL software was used to test the structural model and validate the proposed hypotheses.

The first step of data analysis was to evaluate the reliability and validity of the measurement model. Convergent validity measures whether items can effectively reflect their corresponding factors, while discriminant validity measures whether two factors are statistically different from each other.

To verify the convergent validity of the constructs we employed the composite reliability (CR) and the average variance extracted (AVE). Composite reliability (CR) ranges from 0.822 to 1.000, which is above the suggested value of 0.70, while average variance extracted (AVE), ranges from 0.701 to 1.000, which is above the suggested value of 0.50. Cronbach's α for all constructs exhibited acceptable reliability of 0.70, and ranges from 0.703 to 1.000 (Table 1).

To determine discriminant validity the Fornell-Larcker criterion was used [22]. According to this there is discriminant validity when the variance among the constructs of a model is lower than the variance that each construct shares with its items. The results of this analysis are presented in Table 1.

Once the reliability and validity of the measurement model have been established, we performed an analysis of the structural model. The structural model was assessed by checking the significance of path coefficients between different factors (Table 2). As it can be seen from the table, all path coefficients were positive, but not all of them were significant. Table 2 also shows which of the proposed hypotheses are supported (with a significance level $p < 0.05$) and which are not.

Table 1. Convergent and discriminant validity

Variable	AVE (>0.5)	CR (>0.7)	Cronbach's *α*	Discriminant validity						
				IQ	PEOU	PU	SysQ	SO	SS	SysUse
IQ	0.865	0.928	0.845	0.930						
PEOU	0.712	0.822	0.703	0.422	0.843					
PU	0.874	0.933	0.856	0.485	0.661	0.935				
SysQ	0.871	0.931	0.862	0.012	0.367	0.187	0.933			
SO	1.000	1.000	1.000	0.743	0.561	0.618	0.362	1.000		
SS	0.896	0.945	0.884	0.680	0.831	0.722	0.301	0.768	0.947	
SysUse	0.701	0.875	0.785	0.603	0.732	0.671	0.364	0.796	0.862	0.837

Table 2. Path analysis

Hypothesis	Path	Path coefficient	*t*-value	Finding
H1	IQ → SysUse	0.331	4.203*	Supported
H2	IQ → SS	0.254	7.887*	Supported
H3	SysQ → SysUse	0.179	2.406*	Supported
H4	SysQ → SS	0.006	0.143	Not supported
H5	PEOU → SysUse	0.376	4.139*	Supported
H6	PEOU → PU	0.661	10.680*	Supported
H7	PEOU → SS	0.404	7.782*	Supported
H8	PU → SysUse	0.228	2.687*	Supported
H9	PU → SS	0.100	1.612	Not supported
H10	SysUse → SS	0.344	6.258 *	Supported
H11	SS → SO	0.768	15.886*	Supported

IQ – information quality, SysQ – system quality, PEOU – Perceived ease of use, PU – Perceived usefulness, SysUse – System use, SS – Students' satisfaction, SO – student outcomes.

* $p < 0.05$

VI. RESULTS AND DISCUSSION

The primary objective of this study was to measure the impact of online learning system on students' satisfaction and student outcomes. Students' satisfaction was predicted (R2 = 0.879) better than student outcomes (R2 = 0.590). This can be explained with the fact that there are other factors that influence student learning outcomes, like motivation, prior experience or skills.

Information quality has significant impact on system use and students' satisfaction. From students' perspectives, the supported materials are essential for acquiring desirable knowledge [23]. These findings are consistent with prior studies, which highlight the fact that it is not enough to provide students with some materials, but it is much more important that those materials are of good quality, and that the course itself is well structured to present them correctly [24, 25]. The online system that supports multiple ways of delivering materials, is likely to be more wildly used.

System quality has significant impact only on system use. This is to be expected given the fact that it is important for students to use user-friendly system that is both reliable and offers a quick response time. So, we can state that the quality of the system should always be maintained.

Perceived ease of use (PEOU) is significant factor for perceive usefulness, system use and students' satisfaction. PEOU is an essential

determinant of perceived usefulness in information systems. It is an important factor related to the acceptance of information technology (according to TAM model), which proved to be true in our case as well. In general, PEOU has a positive effect that can lead to system use. It encourage the students to use the system in order to continue the learning process and to complete their tasks faster and with high quality. Although in our case the use of online system was mandatory, this claim was confirmed in our research as well. Path analyses show that PEOU also has a significant positive impact on students' satisfaction. Students have a positive impression of using online learning system, they find it easy to use and they feel comfortable interacting online with colleagues and educators.

In accordance with other research, perceive usefulness has direct and significant impact on system use [26, 27, 28]. Our research is in agreement with these studies. This is probably due to the fact that the students perceived that the system would be useful for accomplishing their tasks, so they actively used it.

A significant relationship was discovered between system use and students' satisfaction, a result consistent with Park et al. [29], who found that the use of information systems influenced user satisfaction. This indicates that online learning system enhance students' satisfaction, even when its use is mandatory, like in our study. One possible interpretation is that participants in this study are computer science students, who are already familiar with online learning technology and have used it to some degree before.

System use also exhibited a strong influence on student outcomes by means of students' satisfaction, demonstrating that the active use of online learning system influences user satisfaction, which subsequently leads to better student outcomes, for students who obtained passing grades. This finding is supported by recent studies indicating that students' satisfaction is significantly related to student outcomes, in terms of examination scores.

VII. CONCLUSION

With the arrival of COVID 19 pandemic, there has been a paradigm shift from traditional face-to-face teaching and learning, to online technology enhanced learning. As predicted this transformation in the educational environment will bring long-lasting effects on teaching and learning process.

The present study is significant in that it comprehensively examined factors partly considered by the TAM and IS success model. It tries to investigate the effect of information quality, system quality, system use, perceived usefulness and perceived ease of use toward students' satisfaction and student outcomes.

The results showed that to increase system use, educators should focus on both system quality and information quality. Good system quality, such as availability, usability, user friendliness and response time will motivate the students to use the system more actively. On the other hand, the system should be ease of use, and students should perceive it as useful for fulfilling their tasks. Such system will provide high level of satisfaction for students, which in turn will lead to positive student outcomes.

With the continuous trend in the increase of utilizing online learning systems in higher education, a need for a better understanding of the effective use of such systems and factors that influence students' satisfaction and student outcomes, will always be appreciated.

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