Exploring the relationship between the usability in use and the adoption of Google Classroom

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Abstract. People's lives changed during the pandemic. Because of the lockdown restrictions universities had to shift from face-to-face teaching and learning to distance education. Since online platforms became the working space for educational activities usability and quality in use became critical issues for technology adoption. However, the relationship between technology adoption, usability, and quality in use has been rarely investigated in extant research. The objective of this research is to develop and test a model that measures the influence of usability in use on the intention to use the Google Classroom platform after the pandemic. The model includes five determinants of continuance intention: extrinsic motivation, intrinsic motivation, effectiveness in use, efficacy in use, and satisfaction. The results show that the model explains a lot of variances in satisfaction and continuance intention. Intrinsic motivation and effectiveness in use were the most important factors.

Keywords: Quality in use, usability in use, TAM, Google Classroom, COVID-19.

1. Introduction

The lockdown restrictions during the pandemic had a major influence on people's lives. A consequence was the shift from face-to-face teaching and learning to distance education which challenged both educators and students (Dhawan, 2020; Toquero, 2020). On the one hand, educators had to change the teaching style and adapt teaching materials in order to be suitable for online presentations. On the other hand, students had to engage in online learning activities which leads to intensive use of online platforms.

Since online platforms became the working space for educational

activities, usability became a critical issue for technology acceptance. However, the relationship between technology acceptance and usability has been rarely investigated in extant research (Lew et al., 2010; Pal & Vanijja, 2020). Technology acceptance plays an important role in the success of e-learning (Al-Fraihat et al., 2020). Existing research shows a wide range of acceptance models developed and tested to answer various research questions related to the implementation of new educational technologies in various contexts of use (Granic & Marangunic, 2019).

The usability of online platforms could be analyzed from two perspectives. The first is the product quality perspective: the capability of a software product to be understood, learned, used, and liked by the users when used under specified conditions (ISO 9126). The second is the quality in use perspective: the extent to which a product satisfies stated and implied needs when used under stated conditions. This is a broader view on usability trying to answer the question: does the interactive system enable users to accomplish the goals of the intended tasks? (Bevan, 1995; ISO 25010)

While most of the existing approaches are relying on the product quality perspective there are few approaches to the integration of the quality in use components into the technology acceptance framework. According to the ISO 25010 standard, quality in use has three main components: usability in use, flexibility in use, and satisfaction. Usability in use has been defined as the degree to which specified users accomplish their goals with effectiveness, efficacy, and satisfaction.

Technology acceptance is driven by several factors. among which the main drivers are the perceived ease of use and the user's motivation (Davis, 1989). Extant literature shows a large variety of technology acceptance models (TAM) as regards the key determinants and their antecedents (Lee et al., 2005; Granik & Marangunic, 2019).

Motivation plays an important role in the acceptance of information technology by influencing the actual use and the intention to continue using the system in the future (Davis et al., 1989). The motivational model explains technology acceptance with two key drivers: extrinsic motivation, which is instrumental, goal-oriented, and intrinsic motivation, which is hedonic, and related to enjoyment.

The purpose of this research is to explore the relationship between the usability in use and the continuance intention to use the Google Classroom platform. To do this, a structural model has been developed that includes five

determinants of continuance intention: extrinsic motivation, intrinsic motivation, effectiveness in use, efficacy in use, and satisfaction. The model has been tested on a sample of 155 university students from a Romanian university.

Google Classroom is an educational platform featuring a wide range of facilities: live interactions, announcements, comments on posts/assignments, and integrated Gmail. Classes, students, and professors are specified for specific disciplines. They may post various learning materials and timelines that summarize the resources, announcements, and other messages. Google Meet is a service associated with google classroom and allows live presentations and screen sharing. Recent research shows that during the pandemic, Google Classroom proved to be a useful educational technology that can significantly increase the effectiveness of e-learning (Alim et al., 2019; Fauzi et al., 2021; Francom et al., 2021).

The rest of the paper is organized as follows. The next section presents the theoretical background and model conceptualization. In section 3, the method and model testing results are presented and discussed. The paper ends with a conclusion in section 4.

2. Theoretical background and conceptualization

2.1 Related work

Lin & Lu (2011) developed and tested a motivational model to analyze the usage of social networking websites. Their results explained a 48% variance in behavioral intention, 61% in intrinsic motivation, and 57% in extrinsic motivation. Intrinsic motivation was the main determinant of the intention to use.

The study of Mailiziar et al. (2021) tested a technology acceptance model (TAM) with two external variables: system quality and e-learning experience. Their findings show that system quality had a significant influence on perceived usefulness.

Pal & Vanijja (2020) took an approach to evaluation that is based on System Usability Scale (SUS) and Technology Acceptance Model. The target platform was Microsoft Teams. The sample has been collected during the pandemic from five universities in India. They got similar results as

regards the perceived ease of use. TAM model testing showed that both perceived ease of use and perceived usefulness are significant predictors that together explain 66.7% variance.

Chuenyindee et al. (2022) made a step forward by integrating TAM, SUS, and task-technology fit (TFF). Task-technology fit (Goodhue & Thompson, 1995), perceived usefulness, and technology characteristics have been conceptualized as antecedents of the perceived usefulness which in turn had a high positive influence on the attitude and perceived satisfaction.

Jakkaew & Hemrungrote (2017) tackles the problem of understanding the student's perceptions using Google Classroom and the UTAUT2 model. The context of the study was a course entitled Introduction to Information Technology at Mar Faf Luang University in Thailand. The study group was very large (almost 3000 students) and they used 25 questions in the study founding that behavioral intention was determined by three main factors: performance expectancy, effort expectancy, and social influence. The students that participated in the study agreed that Google Classroom is good and easy to use even if they didn't use all the features and their full capability.

Albashtawi & Al Bataineh (2020) used the context of studying English as a foreign Language in order to investigate the effect of using Google Classroom. The student group was smaller than the previous one having only 26 Syrian diploma students and the researchers employed a quasi-experimental design based on quantitative data. Their results showed that Google Classroom improved reading and writing performance and the students showed a positive attitude towards using the platform in terms of ease to use, usefulness, and accessibility.

The study of Gupta & Pathania (2021) also explored the impact of using Google Classroom but from the perspective of the teacher's education level. Their sample was consisting of 60 students from one college of education in Jammu City. The data analysis showed that the students accessed the learning activities easily and the results showed that the students could regularly access online resources. The difference between this and the previous two studies is that this one explored Google Classroom from both student and teacher perspectives and in addition revealed that teachers were able to provide better individual attention and students developed a group feeling.

Francom et. al. (2021) had a different approach and despite analyzing the usability of Google Classroom, they decided to compare it with Brightspace using the technology acceptance model (TAM). For their scenario, they used

the platforms in higher education studies (k-12) to support online activities that occurred in conjunction with face-to-face courses. Two courses were used in the study and one section was supported by Google Classroom and one by Brightspace the authors state that the results revealed in the study will be useful for higher education institutions that may be considering adopting Google Classroom.

The work of Moonma (2021) evaluated Google Classroom by testing TAM on 111 students from Thailand in the context of the COVID-19 pandemic. In this case, the group consisted mostly of females (79.28%) with ages between 19 and 23 years old. The paper used a Google Form questionnaire and a semi-structured interview for data collection and descriptive statistics they used means and standard deviation. The results revealed that students had a high perception of Google and found it useful in submitting assignments.

2.2 Research model and hypotheses

In this study, we propose a research model that includes the perceived usefulness, the perceived enjoyment, and the three components of usability in use: effectiveness, efficiency, and satisfaction.

The perceived ease of use has not been included for two reasons. First, perceived ease of use is a usability characteristic of the software product. As such, it does not refer to the degree of accomplishment of users' goals. Second, as several recent studies showed, the perceived ease of use of learning platforms has been highly scored by students and has little influence on the perceived usefulness and on behavioral intention to use.

For example, in the study of Macavei et al. (2021), the mean values of the perceived ease of use ranged from 4.77 to 4.78 on a 5-point scale and the path to the perceived usefulness was non-significant. Another example is the recent study of Pribeanu et al. (2022) that reported mean values ranging from 4.17 to 4.27 and the paths to the perceived usefulness and continuance intention are non-significant.

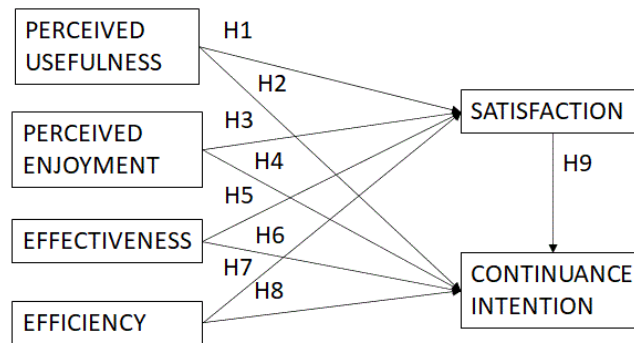The research model is presented in Figure 1.

Figure 1. The research model

In this study, usability in use refers to the effectiveness (EFN), efficiency (EFC), and satisfaction (SAT) of using Google Classroom by Romanian university students during the pandemic. The operationalization of usability in use components is adapted from the definitions of effectiveness, efficiency, and satisfaction in the ISO standard 25010.

Perceived usefulness (PU) has been defined as a belief that using a given technology will improve job performance (Davis, 1989). TAM posits that perceived usefulness has a positive influence on the behavioral intention to use the technology. In the technology acceptance theory, perceived usefulness conceptualizes extrinsic motivation.

> H1. *Perceived usefulness has a positive effect on perceived enjoyment (PU→SAT).*
>
> H3. *Perceived usefulness has a positive effect on perceived enjoyment (PU→BI).*

Perceived enjoyment (PE) has been defined as a belief that using a given technology will be an enjoyable activity, apart from any outcome (Davis, et al., 1989). The extended TAM including intrinsic motivation posits that perceived enjoyment has a positive influence on the behavioral intention to use the technology.

> H3. *Perceived enjoyment has a positive effect on satisfaction (PE→ SAT).*
>
> H4. *Perceived enjoyment has a positive effect on the intention to continue using Google Classroom (PE→BI).*

The effectiveness (EFN) is related to the completitude and accuracy with which university students are achieving their learning goals. It is expected that effectiveness will positively influence both satisfaction and continuance intention.

> *H5. Effectiveness in use has a positive effect on satisfaction (EFN→ SAT).*
>
> *H6. Effectiveness has a positive effect on the intention to continue using Google Classroom (EFN→BI).*

Efficiency (EFC) refers to the effort and time needed to perform learning tasks. It is expected that efficiency will positively influence both satisfaction and continuance intention.

> *H7. Efficiency has a positive effect on satisfaction (EFC→SAT).*
>
> *H8. Efficiency has a positive effect on the intention to continue using Google Classroom (EFC→BI).*

Satisfaction (SAT) refers to the degree of accomplishment of learning tasks and the results obtained.

> *H9. Satisfaction has a positive effect on the intention to continue using Google Classroom (SAT→BI).*

The constructs have been operationalized by adapting existing scales in the literature (Davis et al. 1989, Davis et al., 1989; Lin & Lu, 2011). The operationalization of constructs is presented in Table 1.

Table 1. Constructs and items

PU	PU1	Google Classroom is useful for my academic work
	PU2	Using Google Classroom will improve my learning achievements
	PU3	Using Google Classroom makes it easier for me to study
PE	PE1	Using Google Clasroom is interesting
	PE2	Using Google Classroom is pleasant
EFN	EFN1	Using Google Classroom I can complete my learning tasks
	EFN2	Using Google Classroom I can accurately complete my work
EFC	EFC1	I can complete my work quickly using Google Classroom
	EFC2	I can efficiently complete my work using Google Classroom
	EFC3	Using the online learning platform I can easier complete my work
SAT	SAT1	I am satisfied with the perceived achievement of my learning goals
	SAT2	I am satisfied with the results I got using the online learning platform
BI	BI1	I intend to use Microsoft Teams in the future
	BI2	I would use Microsoft Teams if it is available after the pandemic

3. Model testing results

3.1 Method

Confirmatory analysis has been used to test the measurement model and the structural model. The measurement model describes the relationships between a construct and its measures (items). The structural model describes the relationships between constructs. The model testing follows a two-step approach to structural equation modeling (SEM) as recommended by Anderson & Gerbing (1988): (1) evaluation of the measurement model for validity and reliability and (2) evaluation of the structural model for overall model fit and hypotheses testing.

The following criteria have been used to assess the validity of the measurement model: unidimensionality by examining the factor loadings, convergent validity through the cut-off values of the composite reliability (CR) and average variance extracted (AVE), and discriminant validity by comparing the square root of AVE with the correlations between constructs (Fornell and Larcker, 1981; Hair et al., 2006).

Based on the recommendations from the literature (Hu & Bentler, 1998; Schermelleh-Engel et al., 2003; Hair et al., 2006), the following goodness-of-fit measures were used: chi-square ($\chi 2$), normed chi-square ($\chi 2/df$), comparative fit index (CFI), goodness-of-fit index (GFI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA).

The models were analyzed with Lisrel 9.3 for Windows (Mels, 2006), using the maximum likelihood estimation method.

3.2 Model testing results

Google Classroom has been intensively used at the University of Craiova in 2020, after the restrictions imposed by the pandemic. A questionnaire has been administrated in the first and second semesters of the year 2021/2022 to students enrolled in computer science programs. Students have been asked to answer some general questions such as demographics (age, gender) and enrollment (university, faculty, year of study), then to evaluate items on a 5-point Likert scale.

A total of 168 questionnaires have been received. A number of thirteen

questionnaires have been eliminated for incomplete data so the final sample has 155 observations (46 M/110 F).

The descriptive statistics (mean value and standard deviation) are presented in Table 2. All mean values are over the neutral value which means that students have a positive perception of the usefulness, enjoyment, and usability in use of Google Classroom.

Efficiency in use and perceived usefulness were the lowest-rated constructs, with mean values ranging from 3.77 to 3.97. Perceived enjoyment and perceived effectiveness in use were the highest-rated constructs, with mean values ranging from 4.14 to 4.28.

All item loadings are statistically significant (t-values > 1.96) and over the threshold of 0.6 which proves the unidimensionality of latent variables. The item reliability (R^2) values are above the suggested standard of 0.50. The composite reliability (CR) values are ranging from 0.810 to 0.935, above the minimum level of 0.70, indicating adequate composite reliability. The values of the average variance extracted (AVE) are also adequate, ranging from 0.681 to 0.839, confirming the convergent validity of the constructs.

Table 2. Descriptive statistics (N=155)

Item	M	SD
PU1	3.83	1.20
PU2	3.97	1.19
PU3	3.92	1.20
PE1	4.21	0.95
PE2	4.28	0.96
EFN1	4.25	1.08
EFN2	4.14	1.12
EFC1	3.77	1.19
EFC2	3.90	1.19
EFC3	3.80	1.21
SAT1	4.21	0.99
SAT2	4.25	0.96
BI1	4.07	1.14
BI2	3.96	1.27

The discriminant validity of the model has been examined through the squared correlation test, following the procedure of Fornell and Larcker (1981). The results in Table 3 show evidence of discriminant validity since the square root of the AVE is greater than the correlations between constructs.

Table 2. Convergent and discriminant validity

	CR	AVE	EFN	EFC	SAT	PE	PU	BI
EFN	0.912	0.839	**0.916**					
EFC	0.935	0.828	0.770	**0.910**				
SAT	0.875	0.778	0.825	0.823	**0.882**			
PE	0.858	0.752	0.668	0.632	0.788	**0.867**		
PU	0.928	0.811	0.656	0.876	0.777	0.637	**0.900**	
BI	0.810	0.681	0.688	0.714	0.664	0.752	0.703	**0.825**

Note: The bold diagonal numbers represent the square root of AVE

A structural equation modeling (SEM) approach was carried on to test the fit between the research model and the data and to check if the hypotheses could be accepted. The model testing results are presented in Figure 2.

The fit between the model and the data is acceptable, as shown by the goodness-of-fit (GOF) indices: $\chi^2=102.71$, df=62, p=0.001, χ^2/df=1.66, CFI=0.980, GFI=0.917, SRMR=0.0307, RMSEA=0.066.

Hypothesis H1 is not supported. Hypotheses H2, H3, and H4 are supported since the paths from PU to SAT ($\beta=0.29$, $p=0.000$), PE to SAT ($\beta=0.33$, $p=0.000$), and PE to BI ($\beta=0.62$, $p=0.000$) are statistically significant at p=0.05 level.

Hypotheses H5, H6, and H7 are also supported, since the paths from EFN to SAT ($\beta=0.33$, $p=0.000$), EFN to BI ($\beta=0.36$, $p=0.016$) are statistically significant at p=0.05 level and the path from EFC to SAT ($\beta=0.28$, $p=0.094$) is marginally significant. Hypotheses H8 and H9 are not supported.
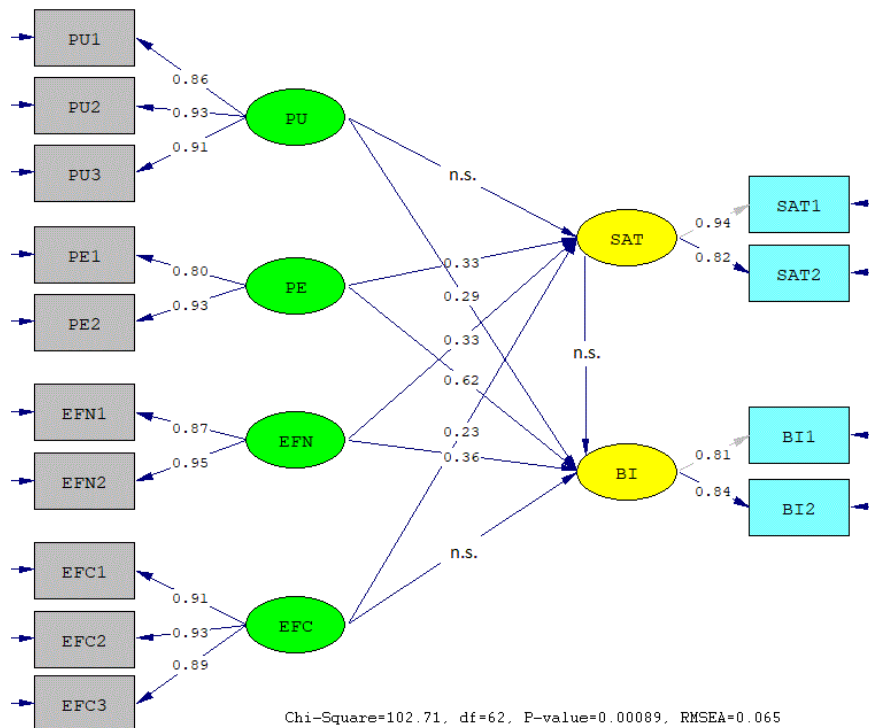
Figure 2. Model estimation results

The model explains 83.50% variance in satisfaction and 73.50% in continuance intention.

3.3 Discussion

This study contributes to an empirically validated model explaining the relationship between usability in use and the intention of continuing to use the Google Classroom platform after the pandemic. The model relates the quality in use model to technology acceptance by including three components of usability in use: effectiveness, efficiency, and satisfaction.

This work goes beyond the traditional approach to technology acceptance that relies on the perceived ease of use by taking a broader view of usability by measuring the influence of the effectiveness and efficiency on the intention to continue using the online platform after the pandemic. The focus is on the quality in use of the learning platform.

The model includes two key determinants of the behavioral intention to use: the extrinsic motivation conceptualized as perceived usefulness and the intrinsic motivation, conceptualized as perceived enjoyment.

Overall, students showed a positive perception of the usability in use and intention to continue using the Google Classroom platform after the pandemic. The highest-rated constructs were perceived enjoyment and satisfaction. Students found the platform interesting and pleasant to learn with and were satisfied by the achievement of their learning goals as well as by their results.

The model testing results showed a high correlation between latent variables, ranging from 0.637 to 0.876. The model explained a lot of variance in satisfaction (83.5%) and continuance intention (73.5%). Perceived enjoyment and efficiency in use were the most influencing determinants of the intention to continue using Google Classroom. Surprisingly, satisfaction had not a significant influence on the continuance intention.

The results are similar to other studies targeting the effectiveness of Google Classroom and its acceptance by university students during the pandemic (Gupta & Pathania, 2020; Fauzi et al., 2021).

The quality in use perspective enables a complementary view of usability by focusing on the effectiveness, efficiency, and satisfaction with which university students are accomplishing their learning goals. In this respect, this approach based on a broader perspective is different from other approaches which mainly rely on the perceived ease of use.

This exploratory study has inherent limitations. The sample is relatively small and students come from only one faculty of a Romanian university. Another limitation is the fact that two factors are measured with only two indicators. Future research will refine and extend the measurement scales.

4. Conclusion and future work

The lockdown restrictions imposed by the pandemic brought in front the online educational platform that ensured the continuity of the educational process. Under this new work situation, usability and technology became important issues.

The results of this study show that the effectiveness in use of the Google Classroom platform is an important factor influencing both the satisfaction and the continuance intention to use the platform after the pandemic.

A future research direction is a comparative analysis as regards the quality in use of other educational platforms (Microsoft Teams, Moodle) and its contribution to the technology adoption.

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