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Exploring the Factors Influencing the Use of Communication and Collaboration Applications

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ABSTRACT

Over the recent years, online communication and collaboration applications have been extensively used in teaching, learning, and research. The aim of the present study is to evaluate the attitudes and perceptions of higher education students concerning these applications and their use in learning activities. The research was conducted on 748 Romanian students. The findings have revealed that social networks represent the main category of communication and collaboration applications used for learning purposes. Additionally, gender-induced differences have been found, as well as variances among undergraduates and graduates by several dimensions of the unified technology acceptance model, while students' learning engagement proved to mediate the relationship between personality traits, technology self-efficacy, and the use of collaboration tools. The paper also offers a comparative analysis between the students' and the academics' responses to the use of online communication and collaboration applications in the same cultural and organizational context. Practical implications are also presented.

KEYWORDS

Actual Use, Behavioural Intention, Communication and Collaboration Applications, Higher Education, Learning Engagement, Performance Expectancy, Personality, Students, Technology Self-Efficacy, UTAUT

INTRODUCTION

Artificial intelligence and automation are changing enterprise work, manufacturing and the retail business, offering original prospects for organizations to explore, while challenging those that do not adapt to the times. Higher education institutions (HEI) must cope with the same trials, but they are slower in accepting them. Over the last decade, studies have emphasized that HEI are apprehensive about competition from training systems using online learning technology, given that most of them rely on face-to-face training and, consequently, need physical students. But research has also underlined that nowadays, regular students are not only involved in classroom-based instruction, but frequently go beyond it, as they also have the possibility of blending traditional instruction with online courses (Anshari et al., 2016; Gibson, 2011; Kemp & Grieve, 2014).

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It is a fact beyond doubt that students enrolled in universities are technophiles by default, possessing unique abilities related to information technology and using technology in a very different way from earlier students. These students are known as favouring experiential activities and teamwork collaboration and they take technology for granted. Staying connected is an important part of their lives, while learning is accomplished through trial and error permitted by the increasing convenience and decreasing cost of use with respect to Online Communication and Collaboration Applications (OCCA). The features of these apps include sharing documents with other individuals, entailing more interaction at group level and increased learning outcomes for students (Cress & Kimmerle, 2008).

Some aspects connected to communication and collaboration are integrated in computer-supported collaborative learning applications and many HEI all over the world do have such integrated internet-based learning systems, thus complying with the constant evolution of internet technologies and innovations. Nevertheless, the favourable outcome of the implementation of these systems depends on extensive knowledge related to the students' and teachers' acceptance process.

The present research started from the desire to see the students' perspective on the use of communication and collaboration technologies in higher education, considering, first of all, that a previous study performed by the authors revealed information with respect to the academics' acceptance and use of these technologies, and, secondly, that few efforts have actually been done so far in studying students' acceptance of communication and collaboration technologies (Al-Emran, Mezhuyev, & Kamaludin, 2018; Al-Shihi, Sharma, & Sarrab, 2018), thus leaving important factors insufficiently covered.

Prior studies have not used the term "online collaboration and communication applications" extensively and consistently and many of them have focused on single collaboration applications, such as Moodle, using technology acceptance models. Moreover, no study considering OCCAs as interconnected applications at user level could be found at the moment of writing this paper. In our opinion, the users could use and in fact they do use more than one application for learning (and working), and they even switch from the formal/imposed applications to more informal ones or to other tools they are familiar with and which they find useful for the rapid exchange of knowledge, as confirmed by certain studies, e.g. (Lissillour, Guechtouli, & Zhang, 2019; Martinho, Almeida, & Teixeira-Dias, 2012). Given the technological and cultural shifts over the past few years and especially the 2020 context, internet-based tools have become part of the educational culture and some of them have lowered barriers to new forms of collaboration or levelled them entirely (e.g. video-collaboration and teaching/learning using Zoom/Google Meet-Classroom / Microsoft Teams). Thus, the continuous development of new online collaboration and communication applications for technology-enhanced learning, on the one hand, and the evidence that human action, including technology-based learning, is guided by behavioural, normative and control beliefs that lead to the behavioural intention and subsequently to the use behaviour (Ajzen & Fishbein, 2000), on the other hand, emphasize the growing importance of research in technology acceptance for learning.

Consequently, this study fills the afore-mentioned gap by integrating the Unified Theory of Acceptance and Use of Technology (UTAUT) with new dimensions (personality, learning engagement, technology self-efficacy and technology anxiety) in order to investigate the antecedents of the students' acceptance of communication and collaboration technologies for learning in the academic context. In line with this, the study seeks to evaluate the attitudes and perceptions of the students from several large and medium-sized accredited universities from Romania with respect to online collaboration and communication applications and their use in learning activities.

Given the increasing interest in these online communication and collaboration applications, the first objectives of our study are to highlight the prevailing applications used by Romanian students as learning means, on the one hand, and to identify the acceptance level and the extent to which these students use them for learning activities, on the other hand. And, because the present research is a logical follow-up of another recent research study (Authors, 2019), we also considered it interesting and useful to draw a comparison between students (the present research) and teachers/researchers (the

previous research) in what concerns the use of online collaboration and communication applications for teaching and learning. Some technology acceptance models have been applied in HEI, including the popular Unified Theory of Acceptance and Use of Technology Scale (UTAUT 2) (Venkatesh, Thong, & Xu, 2012), which has been already validated for the Romanian population in a previous research study (Authors, 2019).

As previous research has shown, anxiety and technology self-efficacy could be relevant predictors of technology acceptance (Authors, 2019; McKenna, Tuunanen, & Gardner, 2013; Wang, Jung, Kang, & Chung, 2014). Starting from these previous results, another objective of this study is to identify which variables of the UTAUT2 model, including self-efficacy and anxiety, better predict the behavioural intention to use (BI) communication and collaboration technologies. Furthermore, our study also aims to demonstrate that not only the external factors are important, but also the students' internal beliefs, attitudes and intensions, as they could explain the online collaboration tools acceptance.

The last objective of the study is to emphasize the advantage of using the communication and collaboration tools in the learning activity, given our conviction that a higher use of these tools predicts a higher learning engagement. As an important variable of the UTAUT model is represented by the behavioural intention, we have also been interested in seeing if the behavioural intention could be translated into the *actual use* of communication and collaboration technologies. Considering this context, we believe it is important to reveal the use of communication technologies through personality traits and learning engagement.

Considering these objectives, we have defined the following research questions in a survey-based research study:

(1) How do students use online communication and collaboration applications (frequency, preference and extent of use) compared to academics?
(2) To what extent does the behavioural intention mediate the relationship between technology acceptance variables and the actual use of collaborative apps?
(3) What are the associations between the typology of using online communication and collaboration applications and technology acceptance on the one hand, and the learning engagement, on the other hand?

From our point of view, the results of this study could be pertinent for both the academic and scientific community, and for the business environment. From the academic perspective, our study could be relevant for the management of higher education institutions because it offers solutions for the adoption and tailoring of communication and collaboration platforms for students, based on their personality traits and motivational dimensions, leading to a more individualised and focused approach. Understanding the way students perceive and use OCCA, academics can adapt their teaching manner and style for improving the communication with the young generation. More than that, HEI can improve their educational offer by including new online courses based on the students' interest in learning by using OCCA. Also, the educational institutions can address the graduates' and post-graduates' needs, thus better supporting the long-life learning process.

From the business environment perspective, the results of the study are relevant for the employers who are looking for digital skills when hiring people. Thus, based on this study, they can have a real image of the students' and graduates' behaviour towards using OCCA while working. Also, business owners can use the results in order to create specialised on-the-job training courses inside their companies.

From the scientific perspective, the results of this study contribute to filling some knowledge gaps concerning technology acceptance among students. We consider it worth mentioning that the method used by this research for assessing the students' perception of OCCA has not been used until now in approaching this topic. Furthermore, these results come to complete a previous study on teachers/researchers regarding the use of online collaboration and communication applications for teaching

and research. Having both perspectives analysed, institutions can find the meeting point between academics' and students' perceptions for implementing better strategies and taking better decisions in order to improve the teaching-learning process, and in the end, the student-teacher relationship in a manner suitable for the digital age.

BACKGROUND

Communication and Collaboration Applications For Learning in Higher Education

As we all know, learning is no longer limited to classrooms. The advent of new tools and applications has enabled students worldwide to collaborate with their peers for learning and gaining better knowledge. Online communication and collaboration applications enable students to communicate and collaborate synchronously and asynchronously, empowering them to sustain their interest and to improve focus for getting quality results in turn.

In this respect, research related to communication and collaboration involve formal online virtual environments for learning, managed by institutions (Schwier, 2012; Veletsianos & Navarrete, 2012), or informal ones, including MOOCs (Ebner, Lienhardt, Rohs, & Meyer, 2010; Razmerita, Kirchner, Hockerts, & Tan, 2019; Sanz-Martínez, Er, Martínez-Monés, Dimitriadis, & Bote-Lorenzo, 2019). In all these cases, the amount of available information and knowledge is much too great, the specialized online search requiring collaborative filtering recommender agent tools integrated in virtual collaborative learning environment, which should consider the students' learning styles (Dascalu et al., 2015).

The communication and collaboration tools allow high interactivity, which has proven to have notable results on online collaboration, providing an enhanced communication medium that improves user experience through connectedness, shared communication, while strengthening the networks of user relationships and information (Du et al., 2018). At the same time, (Khalil & Ebner, 2017) argue that synchronous communication tools such as Google Hangouts or chat/Slack are more useful and have a higher level of satisfaction regarding online teamwork than asynchronous communication tools (e.g. discussion boards and e-mails) for developing collaborative learning skills in online group activities. Also, synchronous editing tend to enhance students' positive attitude in the learning process, as they involve students in collaborative writing and augment interactions among members (Al-Samarraie & Saeed, 2018).

We believe that some of the interactions are due to the way communication and collaboration tools are chosen at group level or are imposed by the tutor. In this respect, (Al-Samarraie & Saeed, 2018) show that social networking tools perform an important role in encouraging online collaborative learning due to their role in offering students a familiar channel for interaction with their colleagues. In addition, due to the increased popularity of Social Networks (SN) in the context of learning and to the little effort necessary for using them (Balakrishnan & Gan, 2016), only the combination of SN and content analysis could deliver comprehensive intelligence regarding the nature and type of interactions between the network users. This supports optimizations on course design and, at the same time, identifies students in danger of dropping out (Cela, Sicilia, & Sánchez, 2015).

As to the socio-economic context of the study, young Romanians (18-24 years) are optimistic about their future in the digital economy, as they seem to be prepared to embrace jobs in the digital world (Vodafone / YouGov, 2018), as also revealed by Eurostat studies. In this respect, Romania follows the trend in EU, 80% of the people aged between 15-34 years with an ICT education being employed (Eurostat, 2019a). Furthermore, the behaviour of young Romanians regarding the use of internet and of gadgets presents no particularities compared to other countries (Eurostat, 2019b). Also, the percentage of Romanian students who have at least basic digital skills is about 66% (mean of European Union- 28 states = 87%), while the percentage of all the individuals in the 16-24 age range is about 56% (mean of European Union- 28 states = 82%) (Eurostat, 2020). As far as the use

of internet for online communication is concerned, it has seen a significant growth lately (99.3% of the university students and high school students over 16 in Romania use it), the most important growth being due to the increase of the voice and video calls on the internet (by 13.2%), by means of dedicated applications (INS, 2019).

Over 35% of the university students and high school students over 16 involved in the aforementioned INS research use the internet to "upload their own productions (text, photographs, music, video, software etc.) on any website which is to be shared by users". Almost 67% of respondents state they spend time on the internet "to listen to music (for instance, radio stations, recorded music)", while 64% use the internet to access information. Until now, no official studies have been issued at national level with respect to IT&C use in education.

Learning Application Acceptance Models – UTAUT

In order to explain the way in which e-learning platforms and communication and collaboration tools for learning have been accepted, two models have been used prevailingly, i.e. the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), with their variants. In our research, we decided to apply UTAUT2 (Venkatesh et al., 2012) , which actually integrates and adapts constructs from previous acceptance models, entailing a refined popular model. The UTAUT model was issued in 2003 and focused on four core constructs, i.e. performance expectancy, effort expectancy, facilitating conditions and social influence. 2012 saw the apparition of an extended version of UTAUT, called UTAUT2, which added the following new constructs: hedonic motivation, habit and price/ customer value. Our choice of UTAUT2 was also motivated by the fact that UTAUT has been used to describe users' technology adoption behaviour in organizational contexts, while the UTAUT2 model gives more emphasis to individual perspectives as regards the technology adoption, which very well suited the scope of our research.

Overall, since it was proposed by Venkatesh et al in 2003, the UTAUT model (2003) and UTAUT2 (2012) have been used extensively worldwide in numerous fields of activity, by reputable academics, scientists and practitioners. Some of the most notable research studies which have used them over time are: (Alalwan, Dwivedi, Rana, & Algharabat, 2018; Zhou, Lu, & Wang, 2010) for adopting mobile banking services, (Kijsanayotin, Pannarunothai, & Speedie, 2009; Yuan, Ma, Kanthawala, & Peng, 2015) for e-health related issues, (Alawadhi & Morris, 2008) for e-governments. In the field of education, it has been used in many studies to research the contribution of information systems to the teaching-learning process, to what extent they represent more of a hindrance or a help. Seminal works such as (Jairak, Praneetpolgrang, & Mekhabunchakij, 2009; Marchewka & Kostiwa, 2014; Singh, Thomas, Gaffar, & Renville, 2016; Tan, 2013; Thomas, Thomas, Singh, & Gaffar, 2013) applied the instrument independently, others also added other constructs, such as learning and teaching styles (Peng-Chun, Hsin-Ke, & Shang-Chia, 2013), trust (El-Masri & Tarhini, 2017), or ubiquity, information quality, system quality, appearance quality and satisfaction (Arain, Hussain, Rizvi, & Vighio, 2019).

But none of these research studies has connected UTAUT to such concepts as students' personality traits, technology self-efficacy, technology anxiety and learning engagement, considered as antecedents of the students' acceptance of communication and collaboration technologies for learning in the academic context. Moreover, the UTAUT model has only been applied in one study in the Romanian context so far with respect to students. Consequently, the combination between UTAUT and some important variables that might occur during the teaching-learning process represents a really novel approach for investigating students' intention to use collaborative technologies for learning, which could offer new insights into their place in education (Yang, 2013).

Performance expectancy, the first construct of UTAUT, refers to the extent to which the use of technology can help an individual when performing specific tasks, being underlain by extrinsic motivation, perceived usefulness, outcome expectations, job-fit and relative advantage (Yang, 2013). According to (Y.-S. Wang, Wu, & Wang, 2009), this construct could be effective in predicting user

progress in learning due to the usefulness of learning management systems for performing their educational activities.

Effort expectancy (EE) is defined as "The degree of ease/effort associated with consumers' use of the technology" (Venkatesh, Morris, Davis, & Davis, 2003) and it is considered a strong predictor of technology acceptance (Wu, Tao, & Yang, 2008), relying on such concepts as the perceived ease of use, complexity, ease of use. (Lin & Lin, 2018) have found that performance expectancy and effort expectancy are not significant factors, effort being irrelevant with today's students immersed in technology.

Social influence refers to an individual's perception of how important the others consider it is to use a new system (Venkatesh & Davis, 2000). It was derived from the constructs of subjective norm and social norm from behavioural theories and it has been proven to play an important role in influencing both the intention to use various technologies in many different contexts and the students' actual use (Ibili, Resnyansky, & Billinghurst, 2019; Wang & Huang, 2018; Zambrano, Kirschner, Sweller, & Kirschner, 2019). Certain studies have revealed that, together with effort expectancy, social influence has a stronger influence on behavioural intentions in the early stages of the adoption process (Gangi, Goh, & Lewis, 2017). However, this factor seems to differ by the technology to be adopted, some authors not finding it significant for the behavioural intention (Alalwan et al., 2018; Gangi et al., 2017).

Facilitating conditions regard the way in which consumers perceive the resources and support available to perform a behaviour (Brown & Venkatesh, 2005; Venkatesh et al., 2003). The construct is based on different variables originating in pre-existing models: perceived behavioural control, compatibility and facilitating conditions (Arain et al., 2019). Among the frequently mentioned facilitating conditions are the technical assistance and the access to resources. Their scarcity, the lack of timely support or the incomplete information or limited access to them have been proven to obstruct students in their acceptance of technology for learning (Ain, Kaur, & Waheed, 2016).

Hedonic motivation is defined in (Venkatesh et al., 2012) as "The pleasure or enjoyment derived from using a technology". (Lee, 2009) emphasizes that the positive feelings and emotions associated with the use of a certain technology trigger a more frequent and constant use of that technology.

Habit is explained by (Venkatesh et al., 2012) as "the extent to which people tend to perform behaviours automatically because of learning". (Crabbe, Standing, Standing, & Karjaluoto, 2009) have argued that previous experiences significantly impact one's beliefs and the behavioural intention regarding the use of new technology. Thus, the use of OCCAs such as content features, blogs, posts etc. on a repeated basis to support learning creates routines, thus building a positive intention towards their use (Ain et al., 2016).

In the UTAUT2 model, price value is defined as "consumers' cognitive tradeoff between the perceived benefits of the applications and the monetary cost for using them" (Venkatesh et al., 2012). This dimension was also subsequently referred to as "customer value" in (Xu, Peak, & Prybutok, 2015). In a formal learning context, students use OCCAs free of charge, because costs are supported by the organization to which they belong. This could encourage students to use these OCCAs also in non-formal learning contexts, the price value demonstrating the possible extension of the original aim of OCCAs and the positive effect on the students' intention to use them in several contexts.

The meta-analysis devised by (Tamilmani, Rana, & Dwivedi, 2020) for UTAUT2, comprising 60 studies and more than 122,000 cumulative observations, has revealed that the effect of behavioural intention on the use behaviour is the strongest path with the values being significant in all cases. In addition, the path performance expectancy- behavioural intention has been shown as the most utilized path, underscoring the emphasis placed by users on the utilitarian value. At the same time, the path effort expectancy-behavioural intention has been found to have the most non-significant path values, its effectiveness being thus questioned.

Apart from the afore-mentioned dimensions, the behavioural intention is also influenced by certain moderators (Dutot, Bhatiasevi, & Bellallahom, 2019). Among them, culture and gender differences

bear special relevance for our study. As regards the relationship between the behavioural intention and the cultural context in which our research was performed, so far it has been approached only in one cross-cultural study in 2013, conducted on Romania, Germany and Turkey. This study extended UTAUT with two additional constructs, computer literacy and computer anxiety (Nistor, Göğüş, & Lerche, 2013) and revealed that Romanian users are moderate in their expectancies towards increased performance, they perceive the strongest social influence and have the lowest facilitating conditions out of the three countries researched. The Romanians report moderate computer anxiety, the lowest computer literacy, the highest technology use intention and the lowest actual use behaviour. As to the effort expectancy of Romanian users, it has the largest influence on the use intention.

Gender differences are also important in relation to technology acceptance, as significant differences in the attitudes towards computers have been highlighted over time. For example, female students are more anxious about using web applications than males in a learning context (Huang, Hood, & Yoo, 2013). However, no such difference has been found regarding social networking and online video sharing tools in the same learning context, a fact justified maybe by the features of social networking and video sharing applications which may encourage females to use them. In addition, research has shown that gender and age play a moderating role: gender, when related to PE with BI, has proven to have a stronger relationship in the case of males than in the case of females (Raman, Don, Khalid, & Rizuan, 2014), and gender differences moderate the effects of social influence (Wang, Wu, & Wang, 2009), because male university students favour status and orientations, while female students prefer social and utilitarian orientations (Liu & Guo, 2017). On the other hand, other studies show that gender has no moderating effects (Khechine, Lakhal, Pascot, & Bytha, 2014; Kim, Pyon, & Yoo, 2017; Magsamen-Conrad, Upadhyaya, Joa, & Dowd, 2015; Nikolopoulou, 2018). Thus, given the novelty of the topic of technology acceptance in the Romanian HEI, we have been interested in discovering if our results regarding gender differences are consistent with previous studies.

Personality and Learning in The Context of Technology Acceptance Models

Despite the increasing research on technology acceptance, the psychological side of the phenomenon seems to be under-researched and the individual differences involved in the adoption of new technologies ignored to some extent. Although dimensions such as technology self-efficacy and anxiety have been discussed, the psychological variables are not consistently included in the structure of the instruments that measure technology acceptance. Previous research has highlighted that anxiety and self-efficacy predict the attitudes towards technology and the actual use of it, the underlying mechanism residing in the rejection of the perceived benefits by those individuals with lower levels of self-efficacy (Meuter, Ostrom, Bitner, & Roundtree, 2003).

Personality traits play an important role in technology acceptance. The core TAM/UTAUT constructs, such as the behavioural intention (BI), has been proven to be influenced by the personality traits and mediated through technology acceptance beliefs (Svendsen, Johnsen, Almås-Sørensen, & Vittersø, 2011). The five-factor model of personality is one of the most widely used models in association with the dimensions of UTAUT. The strong associations between personality traits and the dimensions of UTAUT have been highlighted in the context of the smartphone use over the last decade (Özbek, Alnıaçık, Koc, Akkılıç, & Kaş, 2014). The results show that agreeableness and neuroticism influence the perceived usefulness and the perceived ease of use, while openness and technology readiness influence the behavioural intention to use various technologies (Amron, Ibrahim, Bakar, & Chuprat, 2019).

As regards the relationship between neuroticism and technology use, no consensus has been reached so far (Barnett, Pearson, Pearson, & Kellermanns, 2015). As the Big Five personality model states, neuroticism is measured on a continuum, ranging from emotional stability (low neuroticism) to emotional instability (high neuroticism) (McCrae & Costa, 1987). Some authors measured this trait under the name "neuroticism", as in the Big Five model, while others, focussing more on the positive side of the spectrum, referred to it as "emotional stability" (Ramírez-Correa, Grandón, Alfaro-Pérez,

& Painén-Aravena, 2019). While (Svendsen, Johnsen, Almås-Sørensen, & Vittersø, 2013) did not find a significant relationship between neuroticism and the intentions to use technology, (McElroy, Hendrickson, & Townsend, 2007) found a positive association between this trait and the willingness to engage in internet commerce, while (Devaraj, Easley, & Michael Crant, 2008) conclude that neurotic individuals consider technological advances as threatening and stressful, and tend to have generally negative thoughts when considering them. It may also be possible, as other authors suggest, that the negative effect of neuroticism on technology use be more applicable to learning situations, and not on technology use in other areas, such as shopping or selling (Barnett et al., 2015).

Regarding extraversion, the findings are also controversial: (Devaraj et al., 2008) showed that extraversion moderated the subjective norm– behavioural intention relationship in the TAM model and (Li, 2016) found that extraversion had a positive effect on the perceived usefulness of technology; (Svendsen et al., 2013) revealed that extraversion impacted behavioural intentions through the perceived usefulness and ease of use. On the other hand, (McElroy et al., 2007) found no significant effect for extraversion in a combined TAM/UTAUT model, whereas Barnet et al revealed that extraversion negatively and directly impacted the actual use of technology (Barnett et al., 2015).

A higher consensus was found for openness to experience, which was reported as positively associated with the intention to use technology. Technology use requires active learning, and therefore openness may be useful in identifying users who are more willing to learn and have high intentions to use technology (Barnett et al., 2015). With regard to conscientiousness, (McElroy et al., 2007) and (Devaraj et al., 2008) showed that this trait is important because it is associated with cognition and organizational processes, behaviours, and outcomes, which make conscientious people more likely to carefully consider whether technology provides a career opportunity, as conscientiousness is related to the enactment of intentions.

Concerning agreeableness, previous research has not found significant impact of this trait on technology acceptance or use (McElroy et al., 2007; Svendsen et al., 2013).

The connection between students' personality and their learning engagement has been studied under the form of engagement as a predictor of objective outcomes, rather than of engagement itself as the outcome (Qureshi, Wall, Humphries, & Bahrami Balani, 2016). Among the personality traits, conscientiousness seems to be an important predictor for almost all the aspects of engagement (Heaven, Ciarrochi, & Vialle 2007; O'Connor & Paunonen 2007), including academic engagement (Kim, Shin, & Swanger, 2009), due to the hard-working and motivated nature of this trait. According to (Komarraju & Karau, 2005), the trait of extraversion seems to be connected to engagement, while neuroticism has been revealed as a negative predictor of academic performance (Laidra, Pullmann, & Allik, 2007). More generally, academic performance seems to be connected to some personality traits, specifically to conscientiousness, openness to experience and agreeableness (Poropat, 2009).

Considering the specialized literature in this field, science and research has yet to show the relationship between personality and technology acceptance. Although, there are articles which apply, integrate or extend UTAUT, none of them focus on the communication and collaboration applications for learning purposes. In addition, we have not come across research which combine motivation and more particularly the learning engagement with technology acceptance and personality traits.

METHODS

Data Collection, Participants and Analysis

The aim of the present study is to analyse the attitudes and perceptions of the students from several higher education institutions in Romania regarding online collaboration and communication applications and their use in the learning activity. Therefore, a cross-sectional research design was used for this study.

Thus, with this aim in mind, we prepared a set of questionnaires implemented on the open source LimeSurvey web application, with the instruments presented below (sample of items in Appendix A). The instruments were translated and adapted from English. Our study followed the principles of the Declaration of Helsinki regarding ethical aspects on human subjects. We did not collect any data that could lead to the identification of the participants. The participants gave their informed consent, while the participation at the study was voluntary and no incentives were offered. The collecting of the data using the questionnaires for this research consisted of two different modalities. Thus, the first step consisted in using teachers' email addresses from the database devised in (Authors, 2019) to ask some of our colleagues (professors in various HEI) to distribute the links for the questionnaires to their students. The links towards the questionnaires were also posted on the official pages of the universities and faculties, together with "call-to-action" texts, which invited students to fill in the questionnaires. Given this double procedure, the total number of students having access to the questionnaire cannot be estimated. 2832 incomplete questionnaires have not been included in the research, most of the respondents not proceeding to the second instrument.

The final sample included in analysis consisted of 747 university students from several large and medium-sized accredited universities from Romania. Given the number of incomplete responses, the completion rate is 26.41%. Among the 747 participants, there were 516 female (69%) and 231 male students (31%), with an average age of 22.4 years, from different levels of study: undergraduates 581 (77.8%), and graduates and postgraduates 166 (22.2%). With respect to the field of study, 285 (38.2%) were enrolled in Science study programs, while 462 (61.8%) were Humanities students.

Considering the size of the sample, the sampling error for a confidence level of 95% is +/- 3.58.

The data was analysed in SPSS and AMOS v.24 for structural equation modelling. The univariate normality of each variable was checked, the variables were normally distributed and also no multivariate outliers were found. The Mardia's coefficient for the assessment of normality in AMOS was also computed, being not significant. The t test was used for inter-individual differences and structural equations were used for the mediation hypothesis.

Instruments

The use of the online communication and collaboration applications scale was developed by the authors in a previous research study (Authors, 2019). As we consider the present study as a follow-up of the previous one, we have used the same instruments to analyse the use of several online communication and collaboration applications, in the case of students this time, applications which university students could use in their learning activities. Therefore, 13 items measured the frequency of using the most popular online collaboration and communication applications such as Google Drive, Mendeley, Office 365, Dropbox, and even text messaging apps such as WhatsApp, Snapchat etc. In our questionnaire, the applications were classified based on their main feature, even though some of them could be enclosed in more than one category (Appendix A-Application categories and examples). We considered the inclusion of these tools in the research based on their difficulty and degree of specialization, starting from the most common ones (email/web-based document management tools like Google Drive/Office 365), and ending with tools like mind-mapping, idea organization or source-code management, all of them being applications for communication and collaboration that are generally encountered in the academic life.

(1) The **Unified Theory of Acceptance and Use of Technology Scale (UTAUT 2**) (Venkatesh, Thong, & Xu 2012) measures seven dimensions of the UTAUT model: performance expectancy (Chronbach's $\alpha = .87$), effort expectancy ($\alpha = .86$), social influence ($\alpha = .78$), facilitating conditions ($\alpha = .83$), hedonic motivation ($\alpha = .78$), customer value ($\alpha = .84$), habit ($\alpha = .79$), behavioural intention ($\alpha = .83$). The 29 items were adapted to fit the academic learning context and the use of online communication and collaboration applications specific to the student learning context. Each item was evaluated on a five-point Likert scale.

(2) The **Technology self-efficacy scale** is a five-item scale, which was adapted from previous research focused on attitudes towards technology (Gu, Zhu, & Guo 2013; Venkatesh et al. 2003); it measures one's individual judgment regarding the capacity to use technology in order to accomplish particular learning goals. The items are evaluated on a five-point Likert scale, α =.85.
(3) The **Technology anxiety scale** (Saadé & Kira 2009) is a four-item instrument measuring the anxiety caused by the use of technology, more specifically the negative emotional states generated by the interaction with a particular technology. The items are evaluated on a five-point Likert scale, α=being high, .80, despite the small number of items.
(4) The **10-Item Big Five Inventory** (Rammstedt & John 2007) is the short version of the Big Five Inventory, suitable for time-constrained settings. The five personality dimensions are assessed by two items for each dimension: Extraversion (sociability and the tendency to seek stimulation in the company of others, α=.70), Neuroticism (emotional stability and impulse control, α=.69), Agreeableness (tendency to be compassionate and cooperative, α=.69), Conscientiousness (tendency to be organized and dependable, α=.69), and Openness (intellectual curiosity, creativity, α=.68).
(5) **The Utrecht Work Engagement Scale** (UWES–short form) (Schaufeli, Bakker, & Salanova 2006) is a nine-item instrument measuring three dimensions of learning engagement (α=.91 for the entire scale): Vigour (high levels of energy and mental resilience while learning, α=.84), Dedication (sense of significance, enthusiasm, α=.84) and Absorption (being fully concentrated and deeply absorbed in the learning activity, α=78). Each item was evaluated on a seven-point Likert scale, varying from 0 (never) to 6 (always).
(6) A final questionnaire included demographic and student-status related questions: age, gender, study program and year of study.

We have also run Harman's single factor test and we concluded that there is no bias according to this test (cumulative loading of 21.37%, lower than the 50% required for this test).

RESULTS

Considering the first objective of the research regarding the prevailing applications used by students as learning tools, the data from Figure 1 show that the most used applications are general social networks and messaging apps, due to their popularity among the young generation. General SN are frequently used by 87.2% of respondents and from time to time by 12.1%. Mobile messaging apps are used all the time by 79.3% of respondents and from time to time by 17.6% of them. The figure illustrates the fact that there are many OCCA never used by most students, mainly: project management (85.5%) and file management (76%), source code management (85.3%), mind mapping (67.3%). An explanation could reside in the students' poor experience in this respect and their young age.

In order to calculate the degree to which the communication and collaboration applications are used by students in their learning process, we calculated an average score, considering the measuring scale with values in the range 0-4, according to Figure 2.

Figure 2 shows that the general SN represent the most frequently used communication and collaboration instrument, having the highest average score – 3.3. The second most important tool used by the majority of students is messaging (chat), with an average score of 3.16.

In order to analyse both perspectives on the use of online communication and collaboration applications, a comparison has been drawn between students and academics, using the results of a previous research study (Authors, 2019).

According to Figure 3, the lowest discrepancies between students and academics in terms of the use of online communication and collaboration applications are in point of document management, video collaboration, mind mapping and source code, showing that both parties may struggle in using

Figure 1. The frequency of using online communication and collaboration applications in learning activity

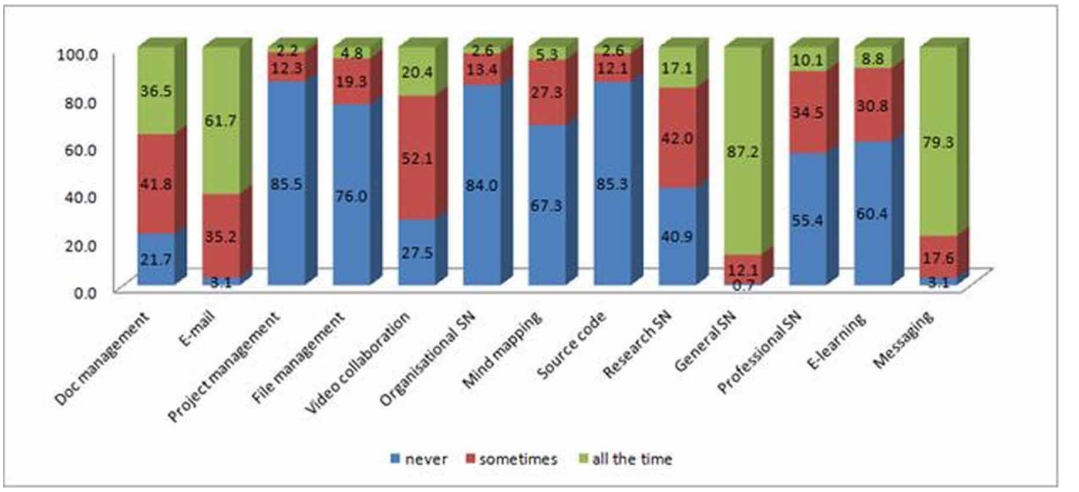
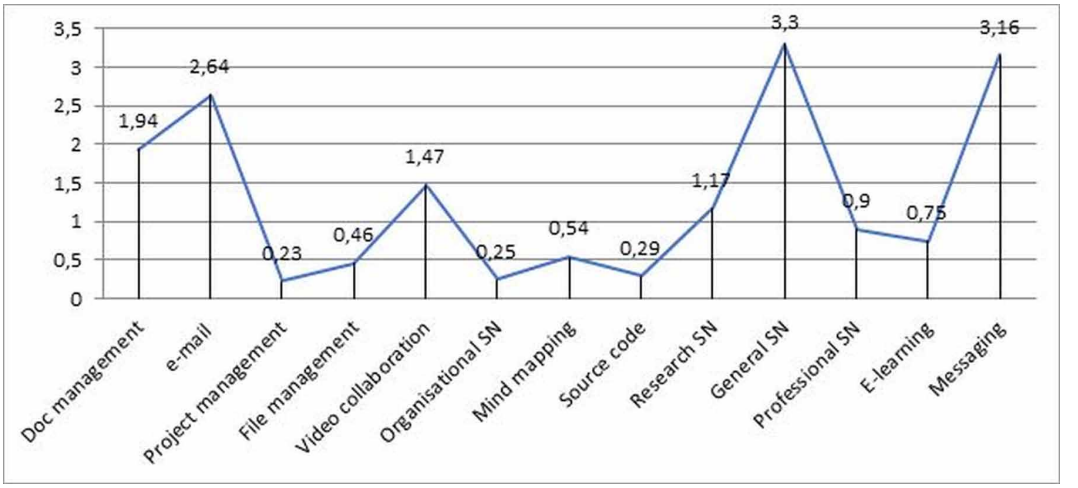


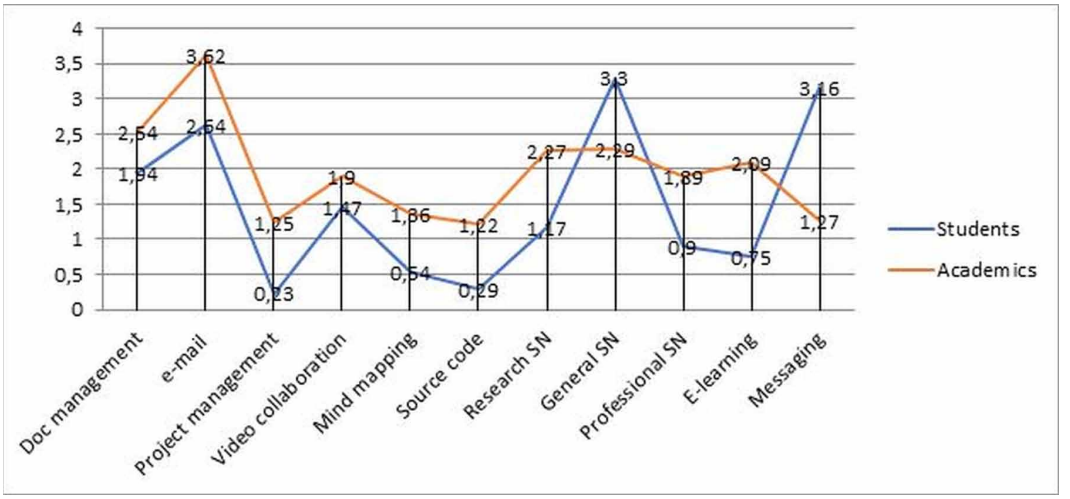
Figure 2. The degree to which online communication and collaboration applications are used by students



these tools in the academic process. On the other hand, the highest discrepancy between students and academics is in point of the use of messaging and general SN (used more by students) and project management (used more by academics).

There is a huge difference between the academics and the students' use of e-learning platforms, with a score of 2.09 for academics and only 0.75 for students (Costa, Alvelos, & Teixeira, 2012). Given the evolution of the collaboration process through SN, we analysed the extent to which these tools are used by students compared to academics. Figure 3 also indicates that students use the general social networks more intensively compared to academics.

Figure 3. Comparisons between students and academics approach of communication and collaboration applications



Gender and Education Level Differences Concerning Technology Acceptance and Use

Our study has revealed some gender differences, female students having significantly higher levels of anxiety, hedonic motivation and habit than male students (Table 1).

We have also found that graduates have higher scores than undergraduates for several dimensions of the UTAUT model. We have also found that graduates exhibit more intentions to use collaboration apps and they actually use them more (Table 2).

Prediction of the Behavioural Intention to Use and the Effective Use of Collaboration Apps

To identify which model from Venkatesh et al (2012) better predict the behavioural intention to use and the effective use of collaboration apps in learning activities, we have developed a path model, including the seven UTAUT dimensions, and also technology self-efficacy and anxiety as predictors, and the behavioural intention as mediator (Figure 4). The model has very good fit indices, the prediction of the behavioural intention being high (Table 3).

The model has highlighted that from all the UTAUT dimensions, the most significant in predicting the behavioural intention to use collaboration apps in learning activities are: performance expectancy ($\beta = .32, p < .01$, habit ($\beta = .22, p < .01$), hedonic motivation ($\beta = .17, p < .01$) and effort expectancy ($\beta = .15, p < .01$). Social influence and customer value were also significant, but weaker predictors than the others ($\beta = .07, p < .05$). Technology self-efficacy and anxiety have insignificant direct effects on the behavioural intention. The behavioural intention, as expected, has a positive effect on the effective use. Our model also reveals several indirect effects, showing that the behavioural intention mediates the relationship between the technology acceptance variables and the use of collaborative apps. Thus, we have found that performance expectancy ($\beta = .06, p < .01$), habit ($\beta = .04, p < .01$), hedonic motivation ($\beta = .03, p < .01$) and effort expectancy ($\beta = .03, p < .01$) have weak but positive indirect effects on the use of collaborative apps.

A multigroup analysis for the groups of undergraduate and graduate students has shown that the groups are not different at the model level ($\chi 2 = 17.86$, df = 13, p = .16), but some differences have been noticed for the following paths: the direct effects of performance expectancy on the behavioural intention ($z = -2.08, p < 0.05$), the effect being higher for undergraduates ($\beta = .36, p < .001$) than for graduates ($\beta = .20, p = .004$); facilitating conditions have also showed differences ($z = 2.02, p <$

Table 1. Gender differences for the technology acceptance and use dimensions

	Gender	*M*	*SD*	*t*	*df*	*p*	*d Cohen*
Technology self-efficacy	Female	3.71	.47	1.66	745	.097	.13
	Male	3.78	.59				
Anxiety	**Female**	**2.27**	**.80**	**5.02**	**745**	**<.001**	**.40**
	Male	1.95	.80				
Performance expectancy	Female	3.66	.71	.05	745	.956	.07
	Male	3.60	.81				
Effort expectancy	Female	3.71	.72	.35	745	.719	.02
	Male	3.69	.81				
Social influence	Female	3.31	.69	.04	745	.966	.01
	Male	3.31	.70				
Facilitating conditions	Female	3.71	.71	.25	745	.802	.02
	Male	3.69	.77				
Hedonic motivation	**Female**	**3.51**	**.72**	**2.00**	**745**	**.045**	**.14**
	Male	3.40	.78				
Customer value	Female	3.78	.77	1.19	745	.234	.08
	Male	3.71	.80				
Habit	**Female**	**3.29**	**.78**	**2.48**	**745**	**.013**	**.20**
	Male	3.13	.80				
Behavioural intention	Female	3.62	.73	1.39	745	.163	.10
	Male	3.54	.83				
USE	Female	1.30	.49	.85	745	.395	.07
	Male	1.34	.51				

0.05), however the effects for each group are not significant: the effect is lower for undergraduates ($\beta = -.03$, $p = .38$) than for graduates ($\beta = .17$, $p = .06$). The third significant difference has been found for the direct effect of behavioural intention on the use of technology ($z = -2.03$, $p < 0.05$), the effect being statically significant only for undergraduates ($\beta = .14$, $p < .001$) and nonsignificant for graduates ($\beta = -.07$, $p = .39$).

Associations Between Personality Traits, Learning Engagement, Technology Acceptance and Use, and Prediction of the Use of Communication Technologies

See Table 4.

One of the aims of our research has been to predict the use of communication technologies through personality traits and work engagement (Figure 5). Our analysis has revealed a model with very good fit indices (Table 5) and several direct and indirect significant effects.

As expected, consciousness has a positive effect on the learning engagement ($\beta = .35$, $p < .01$), while neuroticism has a significant negative effect ($\beta = -.17$, $p < .01$). Technology anxiety has no significant effect on the learning engagement, but technology self-efficacy has a significant positive effect ($\beta = .21$, $p < .01$). The results show that high conscientiousness, high emotional stability (low neuroticism) and high technology self-efficacy predict high learning engagement. On the other hand, the learning engagement predicts the use of technology in learning activities, the effect being positive

Table 2. Study level differences for the technology acceptance and use dimensions

	Education level	*M*	*SD*	*t*	*df*	*p*	*d Cohen*
Technology self-efficacy	undergraduates	3.71	.52	**2.53**	**745**	**.012**	.22
	graduates	3.82	.47				
Anxiety	undergraduates	2.18	.79	.71	745	.474	.06
	graduates	2.13	.87				
Performance expectancy	undergraduates	3.62	.75	**2.76**	**745**	**.006**	.24
	graduates	3.80	.70				
Effort expectancy	undergraduates	3.66	.76	**3.31**	**745**	**.001**	.29
	graduates	3.87	.67				
Social influence	undergraduates	3.29	.69	1.44	745	.149	.13
	graduates	3.38	.68				
Facilitating conditions	undergraduates	3.68	.75	1.72	745	.084	.14
	graduates	3.79	.66				
Hedonic motivation	undergraduates	3.43	.76	**3.42**	**745**	**.001**	.29
	graduates	3.64	.64				
Customer value	undergraduates	3.73	.81	1.82	745	.069	.16
	graduates	3.85	.66				
Habit	undergraduates	3.19	.80	**2.97**	**745**	**.003**	.27
	graduates	3.40	.74				
Behavioural intention	undergraduates	3.54	.78	**3.53**	**745**	**<.001**	.33
	graduates	3.78	.66				
USE	undergraduates	1.27	.47	**4.20**	**745**	**<.001**	.37
	graduates	1.46	.54				

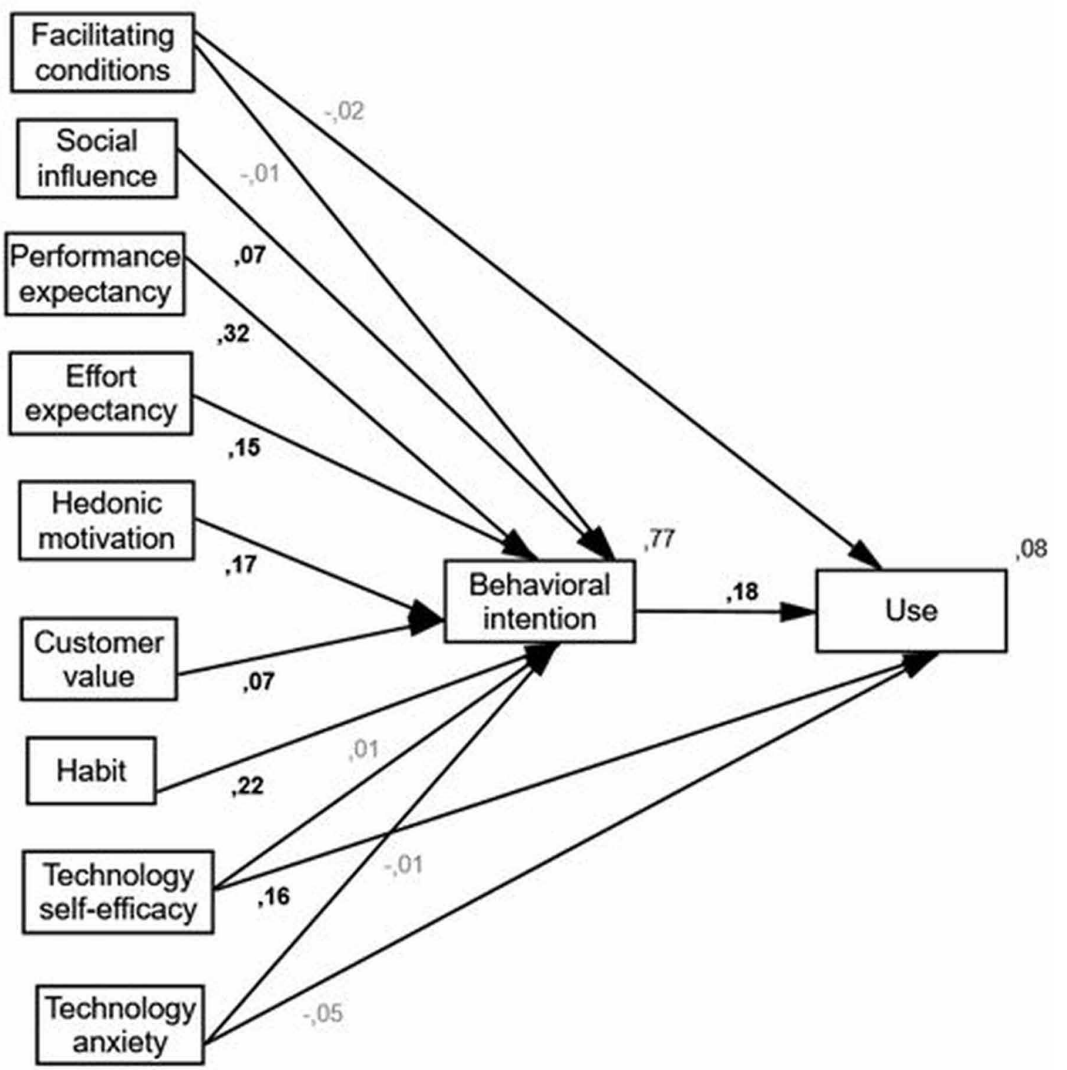
Table 3. The Goodness-of-fit measures for the prediction of the use of collaboration apps

CMIN	*GFI*	*CFI*	*TLI*	*AIC*	*RMSEA* **CI (LO – HI)**
1.56	.997	.999	.995	128.49	.02 (.01-.05)

Notes. GFI: Goodness-of-Fit Index, *CFI:* Comparative Fit Index, *TLI:* Tucker-Lewis Index, *AIC:* Akaike Information Criterion, *RMSEA:* Root Mean Square Error of Approximation.

and statistically significant, $\beta = .16, p < .01$. Significant indirect effects have also been found, showing that the learning engagement could mediate the relationship between personality traits, technology self-efficacy and the use of collaboration tools. Technology self-efficacy has a positive indirect effect on the use behaviour ($\beta = .03$, $p < .01$), neuroticism has a negative indirect effect ($\beta = -.03$, $p < .01$), and conscientiousness a positive indirect effect ($\beta = .05$, $p < .01$). Thus, high technology self-efficacy, high emotional stability low neuroticism and high conscientiousness explain the higher learning engagement which, in turn, explains the more intensive use of collaboration apps during the learning process.

Figure 4. Path model for the use behaviour (standardized direct effects)



A multigroup analysis for the groups of undergraduate and graduate students has shown that the groups are not different at the model level ($\chi 2 = 14.26$, df = 10, p = .16), but there are some differences at the path level. The only significant differences have been found for two paths: the direct effect of openness on the learning engagement ($z = 2.53$, $p < 0.05$), the effect being insignificant for undergraduates ($\beta = .02$, p = .69) and significant for graduates ($\beta = .33$, p = .002), and the direct effect of agreeableness on engagement ($z = 2.\ 17$, $p < 0.05$), the effect not being significant for undergraduates ($\beta = .07$, p = .39) and significant for graduates ($\beta = .30$, p = .04).

A *K-Means cluster* analysis has been run in order to analyse if the participants could be classified in categories depending on the level of their use of collaboration tools and on the UTAUT dimensions, also considering anxiety and self-efficacy. The results have revealed a two-cluster solution (Figure 6).

Participants in Cluster 1 (N = 479) have higher levels for all the dimensions and also a higher use of collaboration tools and a lower level of anxiety. They scored highest on the EE scale, meaning that they feel they can use OCCAs based on facilitating conditions, as long as they feel that these

Table 4. Pearson correlation coefficients between personality traits, work engagement and technology acceptance

	A	C	N	E	O	Vigour	Dedication	Absorption	Learning engagement
Technology self-efficacy	**.25*****	**.21*****	**-.20****	**.19*****	**.16*****	**.21*****	**.33*****	**.25*****	**.30*****
Anxiety	**-.20*****	**-.14*****	**.20*****	**-.17*****	**-.18*****	**-.10*****	**-.21*****	**-.10*****	**-.15*****
Performance expectancy	**.07***	**.08***	-.04	.02	**.08***	**.10****	**.10****	**.15*****	**.13*****
Effort expectancy	**.09****	**.07***	-.01	.02	.05	.06	**.08***	**.11****	**.10****
Social influence	.05	**.07***	-.01	.001	.02	**.11****	**.10****	**.15*****	**.14*****
Facilitating conditions	.05	.03	-.03	.01	.07	**.09***	**.10****	**.14*****	**.13*****
Hedonic motivation	**.08***	.05	.01	.01	.04	**.11****	**.10****	**.13*****	**.12*****
Customer value	.05	.03	.01	.05	.05	**.07***	**.10****	**.10****	**.10****
Habit	.03	.05	**.08***	-.05	.027	**.08***	.05	**.10****	**.09***
Behavioural intention	**.07***	**.07***	-.02	-.04	.04	**.13*****	**.10****	**.15*****	**.14*****
USE	.03	**.14*****	**-.09***	**.10****	.06	**.20*****	**.17****	**.18*****	**.21*****

Notes. ** $p < .01$, *** $p < .001$, $N = 747$, A = agreeableness, C = conscientiousness, E = extraversion, N = neuroticism, O = openness.

Table 5. The Goodness-of-fit measures for the prediction of the use of collaboration

CMIN	*GFI*	*CFI*	*TLI*	*AIC*	*RMSEA* **CI (LO – HI)**
1.96	.997	.995	.963	89.82	.03 (.01-.06)

Notes. GFI: Goodness-of-Fit Index, *CFI:* Comparative Fit Index, *TLI:* Tucker-Lewis Index, *AIC:* Akaike Information Criterion, *RMSEA:* Root Mean Square Error of Approximation.

apps are ready to be used for learning. The score on the high behavioural intention could indicate a wish to use OCCAs effectively, instead of tryout for learning. Thus, we labelled this cluster High acceptance and use of technology.

The participants in Cluster 2 ($N = 268$) have lower levels for all the dimensions and a higher level of technology anxiety. Hedonic motivation, which plays an important role in adopting information systems, seems to have the lowest value among these users, indicating low experimental behaviour. Members of this group also have lower social influence values, indicating that peers play no role in the adoption process. Lower performance expectancy may indicate that they do not find the OCCAs so useful for learning, while their low effort expectancy may indicate their difficulty in using OCCAs, although they have high values of technology self-efficacy. We labelled this cluster Low acceptance and use of technology.

The differences between the two clusters are statistically significant, the F test having $p < .001$ for all the dimensions included in the analyses.

The *t* tests for independent samples have revealed significant differences for one personality trait (agreeableness) and for the learning engagement between the two obtained clusters, with participants included in cluster 1 being more agreeable and having higher levels of learning engagement compared to the participants in cluster 2 (Table 6).

The two cluster groups have been compared to several characteristics of the participants: gender, level of study, study domain. Linking the profiles to the socio-demographics and educational characteristics of the participants has revealed the following results: there was no significant association between cluster membership and gender: $\chi 2(1) = .26$, $p = .60$; the level of study shows significant associations: $\chi 2(1) = 10.37$, $p = .001$, while undergraduates distribution is approximately more equilibrate for the low (N = 226) and high acceptance cluster (N=355), the majority of the graduates

Figure 5. Path model for the use behaviour (standardized direct effects)

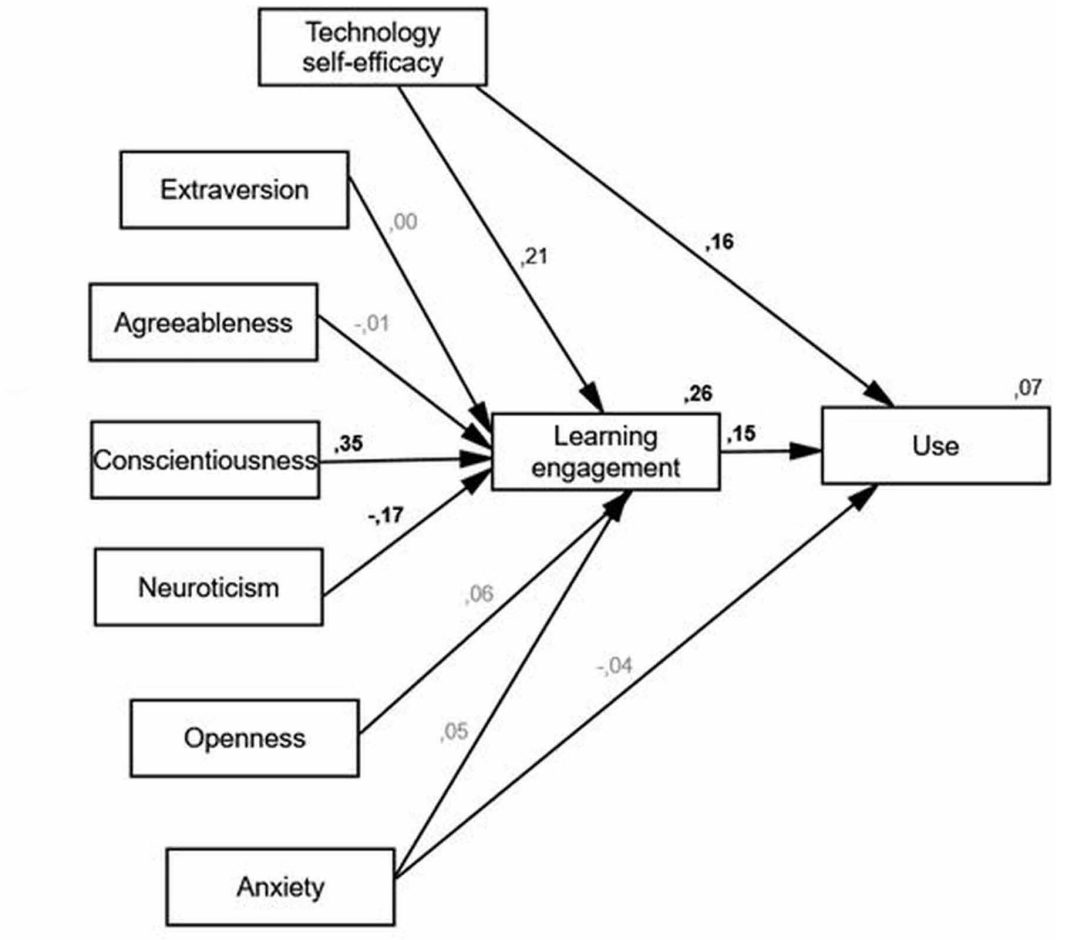
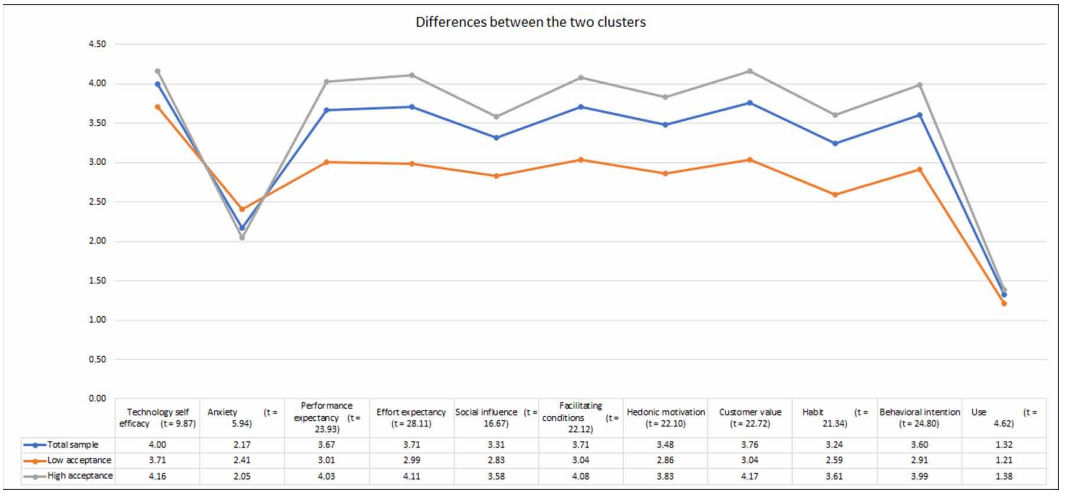


Figure 6. Differences between the clusters for technology acceptance and use of collaboration tools



	Technology self efficacy (t = 9.87)	Anxiety (t = 5.94)	Performance expectancy (t = 23.93)	Effort expectancy (t = 28.11)	Social influence (t = 16.67)	Facilitating conditions (t = 22.12)	Hedonic motivation (t = 22.10)	Customer value (t = 22.72)	Habit (t = 21.34)	Behavioral intention (t = 24.80)	Use (t = 4.62)
Total sample	4.00	2.17	3.67	3.71	3.31	3.71	3.48	3.76	3.24	3.60	1.32
Low acceptance	3.71	2.41	3.01	2.99	2.83	3.04	2.86	3.04	2.59	2.91	1.21
High acceptance	4.16	2.05	4.03	4.11	3.58	4.08	3.83	4.17	3.61	3.99	1.38

Table 6. Differences between the two clusters for the personality traits and learning engagement

	Cluster	*M*	*SD*	*t*	*df*	*p*	*d Cohen*
Agreeableness	**High acceptance**	4.29	.56	**2.69**	**745**	**.007**	**.20**
	Low acceptance	4.17	.61				
Conscientiousness	High acceptance	3.50	.75	.32	745	.747	.02
	Low acceptance	3.48	.76				
Neuroticism	High acceptance	2.84	.89	-.71	745	.478	.05
	Low acceptance	2.89	.87				
Extraversion	High acceptance	3.50	.73	.52	745	.603	.04
	Low acceptance	3.47	.74				
Openness	High acceptance	3.65	.80	.93	745	.356	.06
	Low acceptance	3.60	.63				
Vigour	High acceptance	2.70	1.36	1.34	745	.179	.10
	Low acceptance	2.56	1.35				
Dedication	**High acceptance**	**3.98**	**1.30**	**3.26**	**745**	**.001**	**.25**
	Low acceptance	3.65	1.31				
Absorption	**High acceptance**	**3.08**	**1.35**	**1.99**	**745**	**.040**	**.15**
	Low acceptance	2.86	1.48				
Learning engagement	**High acceptance**	**3.25**	**1.19**	**2.46**	**745**	**.014**	**.18**
	Low acceptance	3.02	1.24				

are included in the high acceptance cluster (N=124) and only some of them in the low acceptance cluster (N=42).

A Chi-square test to investigate the association between the cluster membership and the faculty was not possible because of the low number of participants per cluster in some faculties; therefore, we grouped the six domains (Mathematics and Natural Sciences, Engineering, Biology and Medicine, Social Sciences, Humanities and Arts, Physical Education) in two categories: Science and Humanities. However, the field of study did not reveal significant associations with the cluster membership: $\chi 2(1) = .55$, $p = .456$.

As a result of identifying the two groups of participants, we were interested in finding out if the personality traits have a different weight in the prediction of the learning engagement through the two different clusters. The linear multiple regression has been used and the multicollinearity diagnosis has shown that the data is suitable for multiple regression, the VIF values being between 1 and 10. The results have revealed that the explained variance for the two groups is nearly similar, but the personality traits explain the learning engagement differently, 23% ($R^2 = .23$, $F = 28.46$, $p < .001$) for Custer 1 and 24% ($R^2 = .24$, $F = 16.16$, $p < .001$) for Cluster 2.

The analysis has revealed that conscientiousness has significant and positive weights in predicting learning engagement, while neuroticism has negative weights for both groups of students. For openness, we have found a positive weight only for the high acceptance use of technology group, while agreeableness and extraversion do not predict learning engagement for any of the two groups. (Table 7).

Table 7. Regression coefficients for the prediction of learning engagement for the two clusters

Cluster	Model	*B*	*SE*	*β*	*t*	*p*
High acceptance	Constant	1.04	.52			
	Agreeableness	.08	.09	.03	.85	.394
	Conscientiousness	**.59**	**.06**	**.37**	**8.71**	**<.001**
	Neuroticism	**-.23**	**.05**	**-.17**	**-4.14**	**<.001**
	Extraversion	-.05	.06	-.03	-.73	.463
	Openness	**.17**	**.06**	**.12**	**2.87**	**.004**
Low acceptance	Constant	1.66	.69			
	Agreeableness	-.08	.12	-.04	-.71	.47
	Conscientiousness	**.61**	**.09**	**.37**	**6.27**	**<.001**
	Neuroticism	**-.27**	**.08**	**-.19**	**-3.41**	**.001**
	Extraversion	.16	.09	.09	1.65	.10
	Openness	-.04	.09	-.02	-.48	.63

DISCUSSIONS

The starting point of our study was represented by the need for a more comprehensive approach regarding the research on technology acceptance in educational contexts, as highlighted by previous research (Berrett, Murphy, Sullivan, & Berrett, Bryan; Murphy, J.; Sullivan, 2012; Pedrotti & Nistor, 2016) and it aimed to compare the use of online collaboration tools used by educational actors, teachers and students. Therefore, while our previous research approached university teachers' and researchers' perspective (Authors, 2019), the present study has considered students.

Comparing Students and Academics Regarding The Use of Online Communication and Collaboration Tools

The results have shown that the most frequently used communication and collaboration instrument is social network messaging (chat). This preference towards instant online communication tools is explained by their raised and sometimes inappropriate expectations of instant feedback for their comments and assignments (Kebritchi, Lipschuetz, & Santiague, 2017). The third online tool preferred by students is the e-mail, which is still a very used communication tool between students or students and academics.

The comparison between academics and students in our sample has shown differences between the academics' and the students' use of e-learning platforms, the academics using platforms more frequently than students. Although e-learning platforms are considered as very useful communication tools by universities, still they are not used by students at their maximum capacity. A study carried out by (Costa et al., 2012), which analyses the functionalities and tools of the Moodle platform and their use by students, shows that, despite the fact that e-learning platforms have a great potential, they are mainly used as a repository of materials.

The comparison between students and academics has also revealed that students use general social networks more intensively compared to academics. It is understandable that they do not use professional social networks so much due to the fact that many of them do not have a job at the moment. But given that they are part of the academic environment, they need to be encouraged to become members of research social networks. This would be a very helpful way for preparing their assessments and thesis.

Inter-Individual Differences (Gender and Education Level)

The research has also investigated inter-individual differences, revealing that, while gender differences are small, study level differences are more important, graduates having higher scores than undergraduates for several dimensions of the UTAUT model and a more intensive use of collaboration tools. One of the most significant difference has been found for technology anxiety, females being more anxious than males, results which have been previously confirmed (Bovée, Voogt, & Meelissen, 2007).

The results also confirm other previous research, showing that individuals attach different weights to various factors that influence their technology use, according to their age or gender (Venkatesh, Thong, & Xu, 2016; Williams, Rana, & Dwivedi, 2015). Previous studies have shown that graduate users' behavioural intentions may be different from the intentions of younger groups (undergraduates in our study). More mature users should have higher levels of effort expectancy and the younger users should be driven by performance expectancy. While these differences have been non-significant in previous research, our study has shown that graduate students have higher levels both for performance and effort expectancy (Al-Qeisi, Dennis, Hsegazy, & Abbad, 2015). Graduates also have higher levels of technology self-efficacy, they are more used to including collaboration tools in their learning activities, and find more pleasure in using them, which can explain the higher levels of the intention to use them and of their actual use.

Prediction of The Behavioural Intention To Use and of The Effective Use of Collaboration Apps

The dimensions of the UTAUT model are significant predictors of the intention and of the actual use of collaboration tools. One of our important contributions is the extension of the UTAUT model, by including two dimensions, i.e. technology self-efficacy and technology anxiety. While technology anxiety does not seem to have important implications, technology self-efficacy has a positive significant influence on the actual use of collaboration tools, showing that students who are confident in interacting with information technology are more involved in using it effectively. These findings have also been confirmed in a previous study, on a teacher sample (Authors, 2019), leading to the conclusion that self-efficacy influences the use of online communication and collaboration applications (Gu et al., 2013). The higher positive impact of performance expectancy on the intention to use collaboration tools has shown that this dimension could be one of the most important motivators for students, as previous research has also demonstrated (Sung, Jeong, Jeong, & Shin, 2015). As a motivator, performance expectancy within the UTAUT framework refers to the value that students attribute to the open communication among group members, the expected outcomes (user feedback, impact on learning and grades) possibly contributing to the improvement of collaborative learning (Yueh, Huang, & Chang, 2015). Effort expectancy also has positive effects on the intention of use, but weaker than performance expectancy, showing that even if nowadays students are highly immersed in technology, the use of online collaboration tools in learning requires effort, contrary to previous results reported in the literature (Godin & Leader, 2017). As expected, habit is a determinant of the intention to use collaboration tools, because the prior use is an important determinant of the actual use (Venkatesh et al., 2012). As previous research has also shown, hedonic motivation plays an important role in determining technology acceptance and use (Brown & Venkatesh, 2005). However, contrary to a previous study (Nistor et al., 2013), social influence, although significant, has a weaker predicting power than other indicators from UTAUT. One of the most important findings is that the behavioural intention mediates the relationship between the dimensions of technology acceptance and the use of collaborative apps, showing that performance and effort expectancy and hedonic motivation influence the intention to use collaboration tools positively, which, in turn, influences the actual use of this tools. However, our study cannot pretend to measure the effective behaviour; due to the use of self-report questionnaires, the distinction between the intention to use online communication and collaboration applications and the effective behaviour is vague.

Associations Between Personality Traits, Learning Engagement, Technology Acceptance and Use and The Prediction to Use Communication Technologies

Another important finding of our study was the prediction of the use of communication technologies through personality traits and learning engagement. Our study has shown that highly conscientious and highly stable individuals are more deeply engaged in their learning activities. We have also demonstrated that individuals with higher levels of technology self-efficacy are more engaged in learning and they also use the collaboration tools more extensively. While the positive role of consciousness on engagement has been highlighted by recent research (Qureshi et al., 2016), the role of neuroticism was under-researched, studies highlighting more its influence on working engagement (Akhtar, Boustani, Tsivrikos, & Chamorro-Premuzic, 2015; Inceoglu & Warr, 2011). Consciousness has also been a significant predictor in studies on academic professionals, but, while for university teachers and researchers extraversion was also a positive predictor of engagement and of the use of collaboration apps, for students, high neuroticism proves to be a negative predictor, while extraversion and the other Big Five personality traits except for consciousness have no effects (Authors, 2019). Our study has also determined that learning engagement mediates the relationship between personality traits, technology self-efficacy and the use of collaboration tools. The effects of consciousness, neuroticism and self-efficacy on the actual use of online collaboration tools, are explained by the learning engagement, which enhances the positive effects of consciousness and self-efficacy and decreases the negative effects of neuroticism. The role of the learning engagement on the use of collaboration tools has revealed significant valuable results, because the studies on this topic are not very common and focus mainly on the associations between active and collaborative learning methods and learning engagement (Noohi, Abaszadeh, & Maddah, 2013).

Another significant result is represented by the discovery of two different typologies of students, regarding their use and online collaboration tools acceptance. The UTAUT model, the two added variables (self-efficacy and anxiety) and the actual use of online tools are able to differentiate significantly between low and high users of technology. The relevance of the two clusters is highlighted by the results showing that personality traits could have different weights in predicting learning engagement for the different groups of students, confirming existing research (Qureshi et al., 2016) and extending the knowledge in the field.

CONCLUSION, LIMITATIONS AND FURTHER RESEARCH

The results confirm that the UTAUT dimensions and other individual variables, such as personality traits, successfully predict user behaviour and can therefore prove useful to all those who are involved in coordinating, advising or cooperating with technology users. And, as university students are part of a generation of heavy users of technology, the knowledge about the online collaboration determinants can undoubtedly contribute to enhancing their learning engagement and educational performance.

Our research has demonstrated that performance expectancy and technology self-efficacy are the most important predictors of user behaviour, followed by learning engagement and conscientiousness. On the other hand, user behaviour is negatively predicted by neuroticism. Therefore, our findings raise important questions, but, given that the specialized studies reported in the literature on these dimensions are quite scarce, they need to be further researched. From our perspective, significant results could be revealed by also adding the learning performance as an outcome variable.

In our study, the OCCA use and, more specifically, the acceptance of the online collaboration tools, does not seem to be significantly impacted by individual factors (personality and technology acceptance), although we have detected in this respect two distinct typologies of students regarding their use of technology. However, we opine that, in order to be able to make sound generalizations, this variable should be further and more efficiently operationalized in future research.

Our study has also revealed which are the most used applications by Romanian students as communication and collaboration tools for learning and their attitude towards using them. The

comparison drawn in our study between the students' and the academics' use of technologies has revealed both similarities and differences. From our perspective, the fact that the students' and academics' use of and preference towards certain technologies are not always convergent should represent a starting point for future research, which should show possible ways to meet the expectations of both stakeholders, as well as the most efficient and beneficial teaching and learning technologies for them.

Our study has some limitations: first of all, it is the unbalanced sample size concerning gender and educational level (the sample included a higher number of female and undergraduate students than males and graduates), which can limit the generalizability of our results about inter-individual differences related to the dimensions of technology acceptance and use.

Secondly, our sample included only Romanian students, but we believe some of our findings could be generalized to the European context if we consider the following facts: the behaviour of young Romanians regarding internet access and use of gadgets presents no particularities compared to other countries (Eurostat, 2019a), the quality culture in the Romanian higher education institutions follows the European and international trend of passage from quality definition, assurance and guarantee from inside the university to outside it (Barbulescu, 2015), a top devised by The World University Rankings in Europe in 2020 mentions nine Romanian universities in the first 500 universities in Europe (the analysis of the universities was based on their teaching environment, research environment, citations/ research influence, industry income and international outlook). The Romanian universities meet the same standards as other European universities, Romanian students and academics being actively involved in their professional development by participating in international events and exchanges, and they benefit from similar equipment as other European universities (Times Higher Education, 2019). Also, since 1999, Romania is part of the Bologna Process, which is a large-scale inter-governmental cooperation to make higher education systems comparable among the European member states. Not to mention that some of the Romanian higher education institutions are accredited by the international quality assurance agencies like the European University Association.

However, as there are variables which are significantly influenced by cultural factors and, possibly by specific academic requirements, only an extension of this study in other countries can prove to what extent we are right.

Another limitation could be connected to the fact that self-report measures have been used and, consequently, the answers may be influenced by the social desirability tendency. Thus, the respondents' effective, real-life behaviour towards the use of online communication and collaboration applications could prove different from the reported one.

In addition, applying the questionnaire via sharing its link using various communication channels has allowed us little control over the completion procedure compared to a face-to-face application, which resulted in a completion rate below our expectations. From our perspective, the incomplete answers are due to the fact that the topic introduced in the initial description of the research on the first page was not attractive for the respondents and to the fact that the total length of the questionnaires required too much time, without any benefits.

To conclude, we consider our research is particularly worth considering due to the practical implications of the findings. Thus, academics can consider adapting their teaching styles, methods and materials with a view to improving the communication with the young generation, to making teaching and learning more efficient and to enhancing the quality of the teaching-learning process. On the other hand, the students' interest in OCCA, in learning how to take advantage of them, can be enhanced by creating appealing learning contexts, to which the use of smart devices and online applications can substantially contribute. But, given that our results show that students would rather use other applications in learning than those intended exclusively for this, teachers should not sidestep, by any means, the issue of the permanent need to adapt their teaching-learning approach, by, inter alia, considering new options that students are already accustomed to.

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APPENDIX A

Sample of Items

Some of the items were adapted to the context of using online communication and collaboration applications (OCCA) for learning.

Application categories and examples – frequency of use with scale: Never, Seldom, Sometimes, Frequently, Always

- Category
- Email
- Online document management (Google Drive, Office 365/Box.com/Dropbox etc.)
- Project management applications (Asana, Trello, Basecamp, Samepage etc.)
- Communication/chat applications with file management (Slack, Mattermost, HipChat, grove etc.)
- Video collaboration (Google Hangouts, Skype, Appear.in etc.)
- Enterprise/organization-level social network applications (Yammer, Podio, eXo Platform etc.)
- Brainstorming, mind mapping, whiteboard and online notes (Mural, IdeaFlip, MindMeister, Nuclio, XWiki, Evernote, Google Keep etc.)
- Source code management applications (Github, Phabricator etc.)
- Online social networks for research and education (ResearchGate, Academia.edu, Mendeley etc.)
- General social networks (Facebook, Twitter, Google+ etc.)
- Professional social networks (LinkedIn, HR.com etc.)
- E-learning applications (Moodle, ATutor etc.)

1. The **Unified Theory of Acceptance and Use of Technology Scale (UTAUT 2**) (Venkatesh, Thong, & Xu 2012), with scale: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree
   Examples of items

- I find the use of OCCA useful in learning (Performance expectancy).
- Learning how to use OCCA it's easy for me (Effort expectancy).
- People who are important to me think that I should use OCCA (Social influence).
- I have the resources necessary to use OCCA (Facilitating condition).
- The use of OCCA has become a habit for me (Habit)
- It's fun to use OCCA (Hedonic motivation).
- My colleagues and I can use OCCA on various devices (Customer value).
- I intend to continue using OCCA (Behaviour intention).

2. The **Technology self-efficacy scale** (Gu, Zhu, & Guo 2013; Venkatesh et al. 2003), with scale: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree
   Examples of items

- Whether the technology content is difficult or easy, I am sure that I can understand it.
- I usually do well using technology.

3. The **Technology anxiety scale** (Saadé & Kira 2009)**,** with scale: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree
   Examples of items

- It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.
- I hesitate to use a computer for fear of making mistakes I cannot correct.

4. The **10-Item Big Five Inventory** (Rammstedt & John 2007)**,** with scale: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree
   Examples of items
   I see myself as someone who….

a. is generally trusting (Agreeableness)
b. has an active imagination (Openness)
c. is outgoing, sociable (Extraversion)
d. gets nervous easily (Neuroticism)
e. does a thorough job (Consciousness)

5. The **Utrecht Work Engagement Scale** (UWES–short form) (Schaufeli, Bakker, & Salanova 2006), with scale: 7-point Likert scale: 0=Never, 6=Always

Examples of items

- When I study, I feel bursting with energy (Vigor)
- My studies inspire me (Dedication)
- I get carried away when I'm studying. (Absorption)