Acceptance and Use of Cloud Computing Systems in Higher Education: An Application of TAM 3 within the Socio-cultural context of Educational Institutions

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ABSTRACT

This research aims to compare the acceptance and usage of the Cloud Computing Systems (CCSs) such as Google Documents in higher institutes within socio-cultural context of the each institution's educational culture The main purpose of the study is to identify and compare the participants' reflects based on the acceptance and usage of CCS in both UK and TR. T-test analyses were carried out between gender and the components of TAM3; the components of TAM3 and the groups, in order to see the differences. One of the main findings of this study is the distinction between the universities in the way of their perception on Computer Anxiety (CANX) in their own educational-culture of each institution context. Furthermore, the participants' perception on the Image (IMG) component has the lowest scores of all of the components of TAM 3 in both countries. Based on the findings, given that students come from different cultures during these times in which mobilization is very important, it is thought that the result achieved in the study is not related to the cultural values of a society but the socio-cultural context of both educational institutions included in the study.

Keywords: *Cloud Computing Systems, TAM 3, socio-cultural comparison, higher institution, Turkey, United Kingdom.*

INTRODUCTION

Due to the advances in technological development, cloud computing has emerged as one of the more popular systems in education. Advancing technologies bring about the problem of having a highly flexible technological infrastructure for educational institutions to analyze their needs properly and meet their expectations in a short time. Cloud computing is a flexible technology that stands out in meeting the needs of institutions with its software, platform and infrastructure services. As an internet-based file storage and sharing platform, cloud computing enables users to access information from anywhere with the internet access and encourage them to learn by ensuring that multiple individuals work in collaboration on the same file without having to install an operating system (Korucu and Biçer, 2017). In addition, as institutions make effort to keep pace with the advancing technologies, they alienate themselves from supporting the learning-teaching activities, which are their actual job, and constantly resort to refreshing and improving their infrastructures based on technological development. The effort to adapt to the technological development may hinder the educational activities, and therefore, important points may be ignored in terms of integration. This is where cloud technologies are needed in education. Indeed, it is stated that cloud computing can have the answers to the questions of educational institutions in regard to the efficient management of their resources (Sultan, 2010), and it is possible to argue that cloud computing is a learning technology open to improvement that can be used in educational settings when its layers of software, platform and infrastructure and a great number of applications are reinforced by appropriate pedagogical approaches.

Since reorganization of in-house infrastructures have the disadvantages of time and budget, it will be more advantageous to prefer dynamic, scalable and flexible cloud computing infrastructures instead (Sarıtaş and Üner, 2013). Cloud Computing Systems (CCSs) support mobility providing users with opportunities to access multiple services (Marston et al, 2011). With CCSs, users can access to information without any geographic, time, and device limitation (Stein et al, 2013; Isaila, 2014).Keeping in mind that education is a critical resource to all nations, it is essential for educational institutions to keep up with emerging technologies and hence provision of better education. To meet the needs and demands of users (e.g., learners, instructors, administrators and other stakeholders) institutions need to spend considerable amounts on their infrastructures. Information and Communication Technology (ICT) is becoming increasingly complex and implementation costs are rising (Venkatesh and Bala, 2008). Cloud computing, in the simplest sense, is defined as how institutions can utilize services such as application, data storage, backup, communication, collaboration, information processing, development, etc. which they expect from their own information systems from third parties via the internet infrastructure (Hamutoglu, 2018b).Cloud computing will have a significant impact on the educational and learning environments, enabling institutes to perform their tasks effectively with reduced cost by utilizing the available cloud-based applications offered by the cloud service providers (Alabbadi, 2011). CCS also allows a more effective learning process as it provides seamless learning experiences (ubiquitous learning). Using cloud technology reduces the cost of deployment and support for software applications, and releases human resources that may be involved in the learning process (Karimovna, Karimovna, & Baltabaevna, 2015). Using CCSs may have an important role to reduce cost in educational institutes, but it is also envisioned that the adoption of the technology should be considered for sustainability. Jasperson, Carter, and Zmud, (2005) suggests that slow adoption and insufficient interest in the use of ICTs are the major problems for many organizations. One of the main reasons for this slow adaptation is thought to possibly be lack of pedagogy. The fact that countries impose constant and stable policies in the use of technology also arises the idea that it may be related to adaptation. A continuity is observed in the country policies regarding the use of technology in education in UK (Eurybase, 2007a). In Turkey, on the other hand, it is not a state policy but a policy constantly changing within the framework of government policies, and therefore, such instability prevents it from becoming a sustainable policy. Given the history of developed countries in terms of their policies for using technology in education (Cafoğlu, 1996), this case can be an important factor in the fact that pedagogical developments have been incorporated into ongoing policies to date. With technology claiming its place in educational setting on an advanced level, adaptation studies need to be accelerated by means of pedagogical techniques. Therefore, it is important to understand “what makes technology useful and easy to use?” (Lee et al., 2003, p. 766). Accordingly, attitudes and beliefs of users are influential in the individual acceptance and adaptation of technology in relation with country’s level of development and sociocultural structure. It has become essential to test and encourage the acceptance of the use of technology in various areas of life. The Technology Acceptance Model 3 (TAM 3) developed by Venkatesh and Bala (2008) is the well-known model that explains technology acceptance with a more comprehensive, nomological, and actionable guidance. So, this research aims to compare the acceptance and usage of the CCSs such as Google Documents in higher institutes within a socio-cultural context.

In summary the objectives of this study are to identify and compare the usage and acceptance of cloud computing systems within the socio-cultural context of the each institution’s educational culture (i.e. the way institution accepts and integrates new technology and teaching practices) with the use of Technology Acceptance Model 3 (TAM3, Venkatesh and Bala, 2008) by the following sub-problems:

(1) To identify and compare the level of acceptance and individual usage of participants' on Cloud Computing Systems (CCSs) with TAM 3 in UK, and TR.

(2) To establish how participants' acceptance and usage of CCSs differ in UK, and TR.

(3) To discover the differences between gender, and acceptance and usage of CCSs in UK, and TR?

LITERATURE REVIEW

Comparative Technology Policy

Polices related to using technology differ by countries' levels of development. Considering the importance of technology in countries' development, there are several differences and similarities in technology usage policies in education and technology curricula between UK, which is a developed country according to World Developments Indicators (2012) data, and Turkey, which is among developing countries.

Technology Education and Curricula in United Kingdom

Polices related to using technology are thought to facilitate the adaptation of technology by students. Indeed, remarking the close relation between technology and development, UK included technology education in the curriculum for the age group of 5-16 years, and following the year 1990, it included the Design and Technology course in the curriculum given the importance of technology in economics (Wilson and Harris, 2004). British Educational Communications and Technology Agency (BECTA) is a state-funded agency which conducts studies on integration of technology into education to improve the use of technology in the national education system and works in cooperation with the industry (Eurybase, 2007a, 36). In addition to this, it is the most important assistant of the ministry in the proliferation of Information and Communication Technologies and e-learning strategies in schools across the country (Eurybase, 2007a, 128). As for the technology curriculum in UK, it is known that the curriculum designed according to a mental process-based approach which aims to provide skills such as designing and problem solving (Lewis, 2000) was prepared by Department for Education and Skills (DfES) and Qualifications and Curriculum Authority (QCA) (Eurybase, 2007a, 128). One of the six key skills that the curriculum applied in tier 1 and 2 that cover the age group of 5-11 years in UK aims to bring to the students is to use information technologies (Eurybase, 2007a, 121), and the mandatory curriculum for the age group of 5-14 years include basic technology courses such as Information and Communication Technology (ICT) and Design and Technology (Eurybase, 2007a, 120). For the age group of 14-16 years, the ICT course has continued to be mandatory while the Design and Technology course ceased to be mandatory (Eurybase, 2007a, 162). It is stated that the technology courses in the mandatory curriculum in UK aim to train individuals who can adapt to rapidly advancing technologies of the future (Rasinen, 2003) and to encourage students to develop the required capacity and value judgements so that they can find effective and creative solutions to the problems they will face in real life. These courses improve the students' technology skills by focusing on design and efficiency, involving the cognitive modelling process and integrating knowledge and motivation to train students as creative individuals for a more livable world (Wilson and Harris, 2004). Furthermore, technology courses are assessed with written, verbal and applied studies, homework and the results of examinations (Eurybase, 2007a, 170), and theoretical assessments have a lower share than project assessments (Charty and Phelan, 2006).

Technology Education and Curricula in Turkey

It is understood from the studies in Turkey that one of the eight basic skills in the primary education curriculum that entered into effect in the academic year of 2005-2006 is the skill of using information technologies (Kıroğlu, 2006). For building these skills, the Technology and Design course which was included mandatorily in the curriculum was given for 2 hours a week in the sixth-to-eighth grades (Şad and Arıbaş, 2010). The Information and Communication Technologies course was elective for one hour a week (MEB, 2007). Later in 2012, it was proposed through the Ministry of National Education Board of Education to implement the curriculum of the Information Technologies and Software course (MEB, 2012). The proposed curricula were updated in 2017, and the standard curriculum proposed within the framework of application include four different domains of learning: 1. Informatics Literacy, 2. Communication Building, Information Sharing and Self-Expression by the Use of Information Technologies, 3. Research, Information Structuring and Cooperative Studying, and 4. Problem Solving, Programming and Development of Original Product. It is seen that in 2018, the curriculum was implemented as Class 1 and Class 2 with the title elective Computer Science course (MEB, 2018).

In the light of the policies developed, it is observed in Turkey that the policies regarding the technology usage have no sustainability, are constantly changed without waiting for the short-term results or are realized without a prior healthy feasibility. It is obvious that this situation has had negative impacts both on country's economy and development; indeed, one of the most concrete examples is how the direct investment efforts in the infrastructure in the FATİH project did not achieve any result in the short term because a healthy field study was absent, the needs were not properly identified and the resources were not specifically analyzed. Remarking that the aspect of curriculum should not be ignored when it comes to the expenditure for technology education, Şad and Arıbaş (2010) suggest that general standards be set for technology education as in the developed countries. Because investment in technology is not a criterion that determines the development of a country. Pohjola (2000) could not find any significant relationship between investments in information technology and growth in his study addressing 39 developed and developing countries. According to the the study performed by Erdil et al (2009) to test the effects of information and communication technologies on growth in 131 countries including Turkey and underdeveloped countries, when physical and human capital accumulation is accepted as a production factor and utilized along with certain control variables, these technologies have a positive impact on the economic growth in underdeveloped and developing countries, and it is important to continue the investments in the said technologies. In fact, the Human Development Indices and Indicators: 2018 Statistical Update which involves the Human Development Index (HDI) as the primary index regularly published by United Nations Development Programme (UNDP) indicate that current and long-term trends provide information on human development (UNDP, 2018a) and draw attention to continuity. Similarly, in the social gender inequality index calculated with the values of reproductive health, women empowerment and economic efficiency, Turkey takes the 69th place by 0.317 among 188 countries, whereas UK is in the 14th place with 0.116 (UNDP, 2018b).

Pedagogical Approaches in Technology Usage

In a report on competitiveness of developing countries and technology transfer, Üreyen (2001) makes an emphasis on technology integration: "One of the factors underlying the productive work is to be able to follow technical innovations and to produce our own technology when necessary. Unfortunately, developing countries are obliged to transfer technology from abroad as they cannot produce technology on their own. Transfer is a process full of traps. When transferring the technology, developing countries encounters a problem of choosing the most suitable one. The way to overcome this problem is to master technology. Those that cannot follow technology closely and are not equipped with sufficient knowledge are subject to the possibility of making a wrong choice any moment." (p.69).

Institutions should be aware of the fact that technology integration can ensure an effective and productive usage only once they integrate the outsourced technologies with their own culture and carry out adaptation studies. Undoubtedly, each technology has its pedagogy, and it is essential to conduct studies for integration of the technology into learning-teaching processes in the classroom. In the literature, there are technology acceptance models effective in individual acceptance and usage and used in integration studies.

While following the emerging and developing technologies in educational environments, the integration of these technologies should be taken into account as well. In order to help with the pedagogical integration of technology, the use of TAM developed by Davis (1989) could assist researchers. This model explains technology acceptance with two factors; perceived usefulness and perceived ease of use. Although TAM is widely used in predicting technology usage trends (Venkatesh and Davis, 2000; Venkatesh and Morris, 2000); it also has its limitations (Lee et al, 2003). TAM is parsimonious in explaining the adoption of technology (Venkatesh and Bala, 2008). Indeed, Venketesh and Davis (2000), and Venkatesh and Bala (2008) state that it is lack of the sufficient rigor to explain acceptance of a technology with few variables such as perceived usefulness, perceived ease of use and attitude. It also lacks the features to consider individual differences. In TAM, ease of use does not have a direct influence on usage, whereas perceived usefulness does (Karahanna, Agarwal and Angst, 2006). In an effort to overcome these deficiencies, TAM was further developed to TAM 2 and now the latest version TAM 3. Since it is not sufficient to explain the acceptance and usage with only perceived usefulness and perceived ease of use, in this study we propose the use of TAM 3.This works well with our assumption that individual differences could have an important role on the acceptance and usage. TAM 3 is a more comprehensive, nomological, and actionable guidance model (TAM3, Venkatesh and Bala, 2008). Agarwal and Karahanna (2000)'s findings show that computer self-efficacy is a significant factor of perceived usefulness. This is because self efficacy is influenced by ease of use, and individuals' use behaviours are also influenced by ease of use (Bandura, 1977). Karahanna, Straub, and Chervany (1999) point at the importance of the experience on the adoption of ICT in their studies. Vallerand (1997) states that extrinsic motivation and intrinsic motivation are two important keys of use behaviour.

Current Practices in Technology Usage

The digital era that we are in is witnessing changes in technology day by day. There is no doubt the Internet has an important role in this. As technological developments continue in a fast pace, cloud computing has emerged as one of the most popular systems. Cloud Computing Systems (CCSs) are internet-based file storage and sharing platform. These systems enable the clients to access information from anywhere via internet connection and encourage them to learn by ensuring multiple individuals work in collaboration on the same file without having to install an operating system (Korucu and Biçer, 2017). CCSs are real-time information technology resources made available via the Internet (Turan, 2014). CCSs are important in promoting and supporting teamwork on a task regardless of geography or time zone. It is the application of technological development in supporting the synchronized and asynchronized teamwork without any time and space limitation.

Educational environments also need to keep up with emerging and developing technologies. To meet the needs and demands of users (e.g., learners, instructors, administrators, and other stakeholders) institutions need to invest significantly in their infrastructures. The increasing complexity of ICT leads to higher investment costs (Venkatesh and Bala, 2008). CCS is a technology that supports learning-teaching activities of institutions without having to invest in their infrastructures constantly. Using CCSs may have an important role in cost reduction for educational institutes, but it is also envisioned that the adoption of technologies should be considered for reliability and sustainability as well. Using CCSs in educational environments brings solutions to creation, cooperative and collaborative work, and integration problems (Garcia- Penalvo et al, 2015).

Zoho, Microsoft 365 cloud applications, and Google applications for education are getting increasingly popular in educational institutions. Today, Monash University, Brown University, University of Benin, many K-12 schools and Department of Education like Vanderbilt University uses the educational version of Google applications (Google Apps for Education, 2019). Moreover, the study results show that Google Drive applications have met the gap of computer sciences in rural and small residential areas and have eliminated the barriers in education for everyone. Google applications can be used in many collaborative and cooperative works such as preparing slides, tables, translations, calendar, Gmail etc.

For example, a teacher can perform an activity for his/her students either inside or outside the classroom to let them comment or discuss a subject. Availability of this technology for students and teachers makes the education independent from place, which means learning beyond the walls. Furthermore, how Google offers its users this application free of charge may be increasing the attraction of Google Drive.

The Significance and Aim of the Study

Google Docs is an example of the software service layer of cloud computing (Piotrowski, 2013) and a web-based application allows users to work in collaboration on a document without the need of any interface and installation. In this sense, it is highly preferred in educational settings. Considering the very developed countries, in most developed countries technological disciplines are male dominant and hence it would be interesting to check if technology acceptance shows any differences between gender groups on the acceptance and usage of Cloud Computing Systems (CCSs). For this reason, the purpose of this study is to find out the impact factors on the acceptance and usage of CCSs comparing Middlesex University in the United Kingdom (UK), and Sakarya University in Turkey (TR) based on gender. As is known, United Kingdom is one of the well-developed countries while Turkey is one of the developed countries. Therefore, this study may shed a light to see how the components of TAM 3 are perceived by the students in order to define the acceptance and usage of CCSs in terms of the countries from two different development categories. Technology Acceptance Model 3 (TAM3) is an extension version of TAM2 which is developed by Venkatesh and Davis (2000). TAM3 presents a complete nomological network of the determinants of individuals' IT adoption and use (Venkatesh and Bala, 2008). Accordingly, it is proposed in TAM3 that general determinants of perceived usefulness is that, subjective norm, image, job relevance, output quality, result demonstrability, and perceived ease of use is consisted by computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability, and two moderators—that is, experience and voluntariness. The proposed model is actually general set of determinants of TAM as a basis for the identification of broadly applicable interventions that can fuel future research (Venkatesh and Bala, 2008), theoretically and pedagogically.

Behavior in social sciences is not all about pure psychology, culture or biology but it is a complex structure composed of interactions among them. Indeed, psychology is stated to be associated with culture and psychology (URL 1). In this sense, this study intends to address the acceptance of Cloud Computing Systems (CCS) with different variables and then compare them within the relationship between psychology, culture and biology beyond behavior. It is also essential to consider what type of educational applications can be created/employed to increase the acceptance and usage of cloud computing. Given the slowness in both institutional and individual adaptation of technology within the framework of policies, it is deemed important to explore the incompatibility between technology and pedagogy. Because technology provides the instruments while pedagogy needs to find ways to promote innovations in a comprehensive, meaningful, useful and entertaining manner. Thus, what makes technology useful and easy to use will be addressed on the pedagogical basis in the comparison of educational applications with the ones in other countries in the study.

This study could give a direction in terms of planning the future learning activities to enhance acceptance and usage. If learners are convinced that technology helps promote teaching and learning, it is more likely to have positive use behaviour (Karahanna, Agarwal and Angst, 2006). Motivation is important in the promotion of learning and teaching activities. When motivation is addressed as an intrinsic or extrinsic motivation (Ryan and Deci, 2000), it is stated to be at different levels and in different orientations in each individual. According to Self Determination Theory (SDT) (1985) different types of motivation based on the different reasons or goals that give rise to an action the most basic distinction is between intrinsic motivation, which refers to doing something because it is inherently interesting or enjoyable, and extrinsic motivation, which refers to doing something because it leads to a separable outcome. Accordingly, considering that TAM3 is based on an adaptation process stemming from individual differences, the variables of computer self-efficacy, perceptions of external control, computer anxiety, and computer playfulness addressed by TAM3 are described as anchor variables; that is, they are associated with individual differences, while the variables of perceived enjoyment, and objective usability are described as adjustment variables which contribute to the adaptation process once the experience has gained within the system (Venkatesh and Bala, 2008). Thus, it is anticipated that the effect of motivation on a given behavior can be effective in the adaptation of technology. Intrinsic motivation is as important as extrinsic motivation. An example of promoting intrinsic motivation can be prior experience of the subject concerned and suitability to their job; this would encourage engagement in new technologies. While planning learning activities which could help to enhance CCSs' acceptance and usage, it is important to take into consideration usefulness and ease of use perception of those involved. The strengths of TAM 3 make it more meticulous in explaining the factors influencing acceptance.

However, in this study it is believed that the integration of the CCSs into educational environments needs to be considered. It is important that the acceptance and individual usage is taken into account, while keeping up with technological advances. Especially university students' acceptance of CCSs will affect their future usage and students' acceptance should be considered in a cultural context. Therefore, in this study it is aimed to compare the participants' acceptance and usage of CCSs between UK and TR. This study will also help to determine the lowest perceived component on the Cloud Computing Acceptance. Using the results of this study could promote the development of more effective learning activities, may help to ease adoption of technologies, and improve acceptance and usage of the CCSs in higher education. Furthermore, comparing the factors between the two groups may help to see the differences on the acceptance and usage of cloud computing within a cultural context. This study may also help promoting the adoption of new ICT developments into education by taking the highest, medium, and lowest components of TAM 3, with the consideration of cultural differences. Understanding student expectations from different cultures may have an impact on facilitating effective learning for culturally different groups of students.

In most developed countries, technological disciplines are male dominant and hence it would be interesting to check if technology acceptance shows any differences between gender groups. The main purpose of the comparison is to see the state of and measure the participants' acceptance of cloud computing systems within the socio-cultural context.

RESEARCH METHOD

Research Model

This research is based on a cross-cultural comparison study to identify and compare the participants' views based on the acceptance and usage of CCS in both UK and TR.

Sample

The data gathered from Middlesex and Sakarya University students studying in 2016-2017 spring term. The sample was created in accordance with the criterion sampling method which is a non-random, purposive sampling method. Accordingly, having taken at least one technology course during undergraduate education was set as the criterion. The reason for choosing this criterion is that experience is a moderator variable in TAM3. Samples drawn from Middlesex University and Sakarya University, undergraduate and postgraduate students. The participants from Middlesex University involve 167 students, of which 61 are female (36.5%), and 106 are male (63.5%). The participants from Sakarya University consists of 421 students, 302 of female (71.7%) and 119 of male (28.3%).

Tools for collecting data

The Technology Acceptance Model 3 developed by Venkatesh and Bala (2008) and adapted into Turkish by Hamutoglu (2018a) has been used for data collection, and in this research, participants' acceptance and usage of CCSs collected with the instrument of Cloud Computing Acceptance Scale (CCAS).

The adapted form of TAM 3 called CCAS includes 45 items, use a seven-point Likert scale from “Strongly Disagree”, to “Strongly Agree”. TAM 3 includes 11 components: Perceived Usefulness (PU), Perceived Ease of use (PEU), Subjective Norms (SN), Image (IMG), Perceived enjoyment (ENJ), Job Relevance (REL), Output Quality and Result Demonstrability (OUT-RES), Computer Playfulness (CPLAY), Computer Self Efficacy and Perceived External Control (CSE-PEC), Computer Anxiety (CANX), and Behavioural intention (BI). Within the components of PU, there are four items, where one example is “Using the system improves my performance in my job.” Similarly, the components of PEU includes four items and one is “My interaction with the system is clear and understandable.” The components of SN includes 4 items, which one is example as “People who influence my behavior think that I should use the system.”. Additionally, each components named IMG, REL, ENJ and BI have three items and “People in my organization who use the system have more prestige than those who do not.”, “In my job, usage of the system is relevant.”, “I find using the system to be enjoyable.” and “Assuming I had access to the system, I intend to use it.” are examples for each components, respectively. Furthermore while the components of OUT-RES has 6 items with the example of “I have no problem with the quality of the system’s output.”, CSE-PEC has seven items with “ If there was no one around to tell me what to do as I go, I could complete the job using a software package.” example. Finally, CANX and CPLAY have both four items with the examples of “Computers do not scare me at all.” and “ I would characterize yourself when I use computers playful.” respectively.

The adapted form of TAM 3 have some cultural differences compared to the original form for factorial invariances (Hamutoglu, 2018a). A test named multi-group confirmatory factor analysis (MGCFA) was applied and both original and adapted form of the instrument provided similar psychometric features.

Data Analysis

Classification of the data collected into three groups as high, medium, and low is descriptive and the intension is to use such classification for future research in collaborative work. In order to compare the differences between the groups based on gender and the usage of CCSs, independent sample t-test was performed using Statistical Package for the Social Science SPSS to see the significance. In addition, to check whether the adapted form have similar psychometric features in both groups, multi-group confirmatory factor analysis (MGCFA) was performed via AMOS 23.MGCFA tests configural, structural and measurement invariance (metric, scalar, residual) analysis which stem from the linguistic invariance measurement of the groups.

Configural invariance aims to estimate the factor loading in different groups when compared with the baseline model (Byrne, 2001; Jöreskog and Sörbom, 1993) while structural invariance shows the structural invariability with the factor variances and co-variances in different groups of latent factors. Metric invariance tests whether the factor loadings of latent variables in the groups are the same or not. On the other hand, scalar invariance checks whether item interceptions between groups are equal in the same factor loading whereas item uniqueness looks for the equality of item error between variances/co-variances groups (Yu and Shek, 2014). The scale development studies are recommended to test the measurement model ufor subgroups (Hair, Black, Babin, and Anderson, 2006), which is performed with multiple group analyses. To this end, measurement models are compared by subgroups, which is called measurement invariance (or measurement equivalence) (Bryne, 2010; Harrington, 2009; Blunch, 2011). Measurement invariance is a measure whether the differentiation of answers given to an instrument is due to the instrument itself. In this research, invariance of the 11-factor scale was tested in terms of language.

FINDINGS

This study aimed to compare the two groups whose participants are from Middlesex University (UK) and from Sakarya University (TR) based on acceptance and individual usage of CCSs in the framework of TAM 3. The collected data were analysed via parametric tests and the findings of the study are presented below. Firstly, Table 1 shows the confirmation of linguistic measurement invariance in both groups.

Table 1. TAM 3 results of linguistic measurement invariance

Linguistic invariance	Model fit					Model comparison			
	χ^2	df	χ^2/df	CFI	RMSEA	Model	Delta CFI	Delta RMSEA	p
M1.Configural	4495.773	1896	2.371	0.85	0.048	-	-	-	<.001
M2.Metric	4595.263	1919	2.395	0.85	0.049	M2-M1	0	0.01	<.001
M3.Scalar	5161.516	1964	2.628	0.82	0.053	M3-M2	-0.03	0.04	<.001
M4.Residual	5767.651	2020	2.855	0.78	0.056	M4-M3	-0.05	0.03	<.001
M5.Structural	5768.310	2021	2.854	0.78	0.056	M5-M4	0	0.01	<.001

As can be seen in Table 1, the results of linguistic measurement invariance in both groups indicate that all models -configural, metric, scalar, residual, and structural- of invariance are established. The results of configural invariances show that it supports the TAM 3 model for the linguistic invariance of both groups compared to the baseline model. In addition, structural invariance indicates that both groups' factor variances and co-variances of latent factors are confirmed. Furthermore, metric invariances demonstrate that the factor loadings of latent variables are the same in both groups. Scalar invariances establish TAM 3 model because the item interceptions are equal in the same factor loadings. Finally, residual invariances indicate that the same level of measurement error variance is in the same manner between the groups.

In the literature, there are two indices which are used for the linguistic measurement invariance analysis: Comparative fit index (CFI) and Root Mean Square Error of Approximation (RMSEA). According to Rigdon (1996), CFI is known to be used in applied research quite frequently although RMSEA has recently started to have its place in this field. Rigdon (1996) further states that whereas CFI is used in exploratory contexts, RMSEA is used in confirmatory contexts. Therefore, in the present study RMSEA fit indices rather than CFI indices are used since this study is aimed at exploring and confirming the fact that there is no invariance between the groups.

Another reason for using RMSEA instead of CFI fit indices was the fact that the CFI indices were lower than the acceptable value .90 (Bentler, 1980). This result can be explained with the unequal sample size of the groups (Rigdon, 1996). Therefore, RMSEA fit indices were taken into consideration for interpreting the results. According to Chen (2007), there is no invariance when ΔCFA$\geq$-0.010 and ΔRMSEA$\geq$0.015. Table 1 shows that the goodness of fit indices (χ2/df<5.00; $p<.001$; RMSEA<.06) are acceptable (Byrne and Campbell, 1999; Byrne, 1998; Ventura, 2011).

In this context, the change in RMSEA indicates that equality of error between the groups are provided. Furthermore, the model provided up to error variances is expressed tightly considering the baseline model (Bagozzi and Edward, 1998). According to the results, it can be expressed that there is no linguistic invariance between the groups compared to the baseline model.

Figure 1 presents the acceptance and usage of the participants' views classified as low, medium, and high based on the first research question.

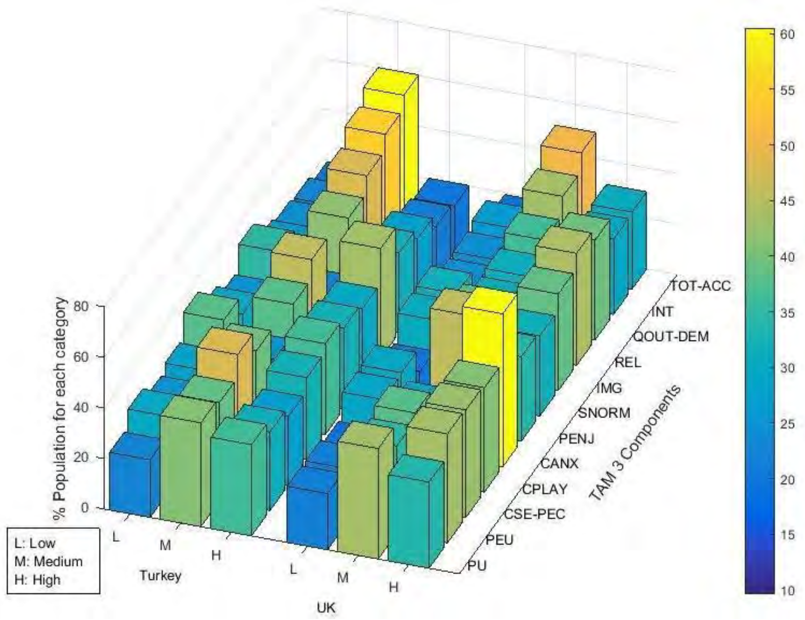


Figure 1. Comparison of groups based on the views of participants' acceptance and usage

According to the Figure 1, the total score of the participants' acceptance and usage of CCSs are ranging between 255.33 and 196.81, and 255.20 and 196.67 in Turkey and UK, respectively. When responses to each component of TAM 3 are considered in both Turkey and UK, Figure 1 shows that Image (IMG) has the lowest score among of the components. This result is followed by Perceived Enjoyment (PENJ) ($16.83>\chi>12.81$); Relevence (REL) ($17.38>\chi>12.89$); Intention (INT) ($18.28>\chi>13.90$); Subjective Norm (SNORM) ($21.14>\chi>15.90$); Perceived Ease of Use (PEU) ($22.62>\chi>17.50$); Computer anxiety (CANX) ($21.05>\chi>17.85$); Computer Playfulness (CPLAY) ($23.75>\chi>18.20$); Perceived Usefulness (PU) ($24.93>\chi>19.68$); Output Quality and Demonstrability (QOUT-DEM) ($34.64>\chi>25.78$) and Computer Self-Efficacy and Perceived External Control (CSE-PEC) ($40.81>\chi>31.09$) in Turkey. Similarly, the lowest score is followed by Computer anxiety (CANX) ($11.36>\chi>12.45$); Intention (INT) ($18.07>\chi>12.68$); Relevence (REL) ($17.72>\chi>13.20$); Perceived Enjoyment (PENJ) ($18.77>\chi>13.97$); Subjective Norm (SNORM) ($21.22>\chi>16.45$); Computer Playfulness (CPLAY) ($21.04>\chi>18.85$); Perceived Ease of Use (PEU) ($24.46>\chi>20.17$); Perceived Usefulness (PU) ($25.21>\chi>20.92$); Output Quality and Demonstrability (QOUT-DEM) ($34.88>\chi>26.33$); and Computer Self-Efficacy and Perceived External Control (CSE-PEC) ($40.77>\chi>33.53$) in the UK.

Responses to the remaining components have similar ranges of scores. One interesting result should be noted that Computer anxiety (CANX) has attracted more responses in UK than Turkey. This result show that the participants have more computer anxiety in Turkey.

The acceptance and usage of CCSs based on groups are analysed with independent sample t-test. According to that, mean values of the significant results between the groups and the acceptance and usage of CCSs are shown in Figure 2.

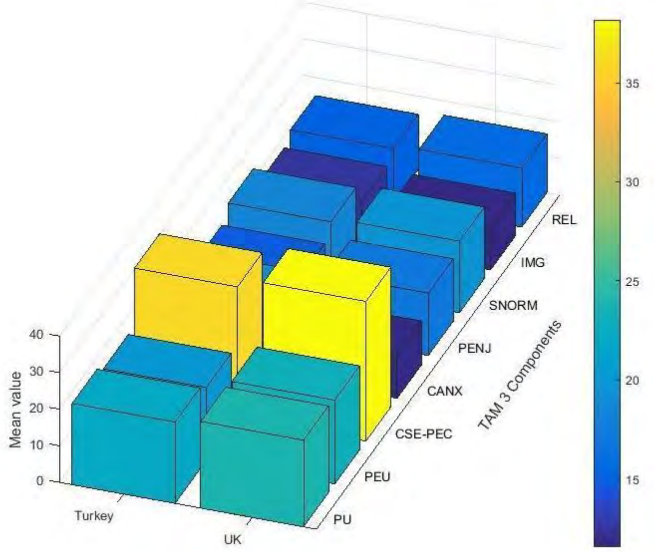
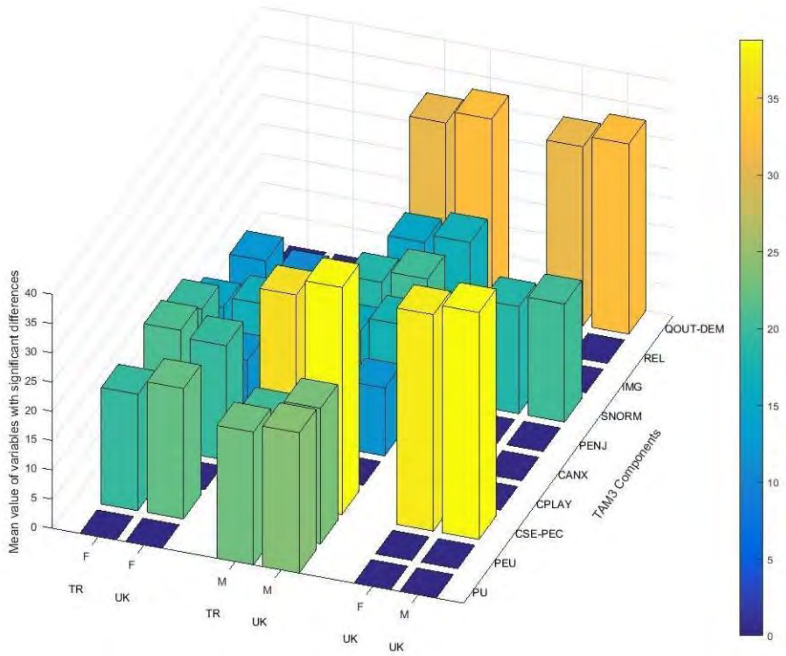


Figure 2. Mean values of the groups based on t-test with the acceptance and usage of CCSs

The results based on t-test show that there are significant differences on Perceived Usefulness (PU) (t=3.753, df (419.130), p<0.01), Perceived Ease of Use (PEU) (t=7.783, df (390.224), p<0.01), Computer Self-Efficacy and Perceived External Control (CSE-PEC) (t=4.105, df (384.870), p<0.01), Computer anxiety (CANX) (t=-21.946, df (505.450), p<0.01), Perceived Enjoyment (PENJ (t=7.038, df (586), p<0.01), Subjective Norm (SNORM) (t=2.489, df (586), p<0.05), Image (IMG) (t=-2.207, df (586), p<0.05), and Relevance (REL) (t=3.012, df (586), p<0.01) between the groups. Figure 2 presents that the PU, PEU, CSE-PEC, and REL components attracted more responses from the UK compared to TR. Contradictory to this, in Turkey, CANX and IMG components attracted more responses than UK.

In Figure 3, the mean values of variables with significant differences based on t-test are presented.



UK: United Kingdom, TR: Turkey

Figure 3. Mean values of the groups based on t-test between gender and the acceptance and usage of CCSs

According to the results based on t-test, considering gender and the participants' acceptance and usage of CCSs between groups show that females show significant differences on components Perceived Ease of Use (PEU) (t=4.528, df (109.998), p<0.01), Computer Playfullness (CPLAY) (t=-2.097, df (111.489), p<0.05), Computer Anxiety (CANX) (t=-14.674, df (140.626), p<0.01), Perceived Enjoyment (PENJ) (t=3.561, df (361), p<0.01), and Image (IMG) (t=-2.698, df (361), p<0.01). Figure 3 manifests that females in UK have higher responses on components Perceived Ease of Use (PEU) and Perceived Enjoyment (PENJ) compared to Turkey. In addition, females in Turkey are highly responsive on components Computer Playfullness (CPLAY), Computer Anxiety (CANX), and Image (IMG) compared to UK females.

Considering male responses significant differences can be seen on components Perceived Usefullness (PU) (t=2,327, df (223), p<0.05), Perceived Ease of Use (PEU) (t=5,236, df (221,105), p<0.01), Computer Self-Efficacy and Perceived External Control (CSE-PEC) (t=3,215, df (223), p<0.01), Computer Anxiety (CANX) (t=-13,912, df (192,661), p<0.01), Perceived Enjoyment (PENJ) (t=5,339, df (223), p<0.01), Subjective Norm (SNORM) (t=3,491, df (223), p<0.01), Relevenace (REL) (t=2,673, df (223), p<0.01), and Output Quality and Demonstrability (QOUT-DEM) (t=2,665, df (223), p<0.01). These results are presented in Figure 3. Accordingly, UK male participants responded highly on components PU, PEU, CSE-PEC, PENJ, SNORM, REL, and QOUT-DEM compared to males from Turkey. In this context, UK male participants' scores are higher than their TR counterparts.

Finally, the results based on t-test for gender groups show no significant differences between the acceptance and usage of CCSs between gender groups in Turkey. In addition to this, there are significant differences on the Computer Self-Efficacy and Perceived External Control (CSE-PEC) (t=-1.994, df (165), p<0.05), Subjective Norms (SNORM) (t=-2.755, df (165), p<0.01), Output Quality and Demonstrability (QOUT-DEM) (t=-2.062, df (165), p<0.05) components and total score (t=-2.740, df (165), p<0.05) of the scale. Figure 3 shows that males in UK have more responses than females on these components.

DISCUSSION

The Results about Turkey

The lowest, middle, and the highest dimensions about CCSs in Turkey

Regarding the CCS acceptance status of the participant Turkish students, the IMG factor seems to be the lowest. It is possible to say that this is because the students are digital natives and their teachers have the characteristics of a generation that met technology much later (Prensky, 2001). In fact, the concept of image is affected by the social effect processes (Hamutoglu, 2018b) and defined as "the degree to which the individual will improve his/her condition of using an innovation in his/her own social system" (Moore and Benbasat, 1991). On the other hand, as for the scale items measuring the perception of image, "the individuals using the system at the university are more prestigious than those who do not use it." This result appears to be significant given the incompetency of the teachers from the digital immigrant generation regarding the technology in the case of Turkish participants. Hence, it is observed how the students did not develop a positive perception of image in terms of technological competence reflected on the results. It is thought that another factor which might be effective in this situation is technology barriers. Technology barriers are described as internal and external barriers caused by time, infrastructure, money, beliefs, attitudes, self-efficacy, etc. in regard to the efforts of faculty members to integrate technology within the classroom (Hamutoglu and Basarmak, 2020). In short, one can think that the discrimination between digital native and digital immigrant comes into play on the perception of image concerning the use of technology.

The Turkish participants were found to have moderate levels of perceived ease of use in terms of CCS usage. The geographical location and cultural characteristics of Turkey may be related to this result; indeed, Lee, Kozar and Larsen (2003) state that ease of use perceived by Eastern societies have a higher effect on acceptance compared to perceived benefit. Although the effect of perceived ease of use on acceptance was not tested in this study, the assumption when it is compared to perceived benefit seems to be meaningful.

Lastly, the Turkish participants had the highest CSE-PEC score; according to Venkatesh (2000), it is related to "individuals' control beliefs about their personal skills of using a system and their control beliefs about organizational resources and presence of an assistance structure in the facilitation of the use of that system." And this situation is associated with the fact that we have the self-efficacy of using technology on an adequate level individually by means of the facilities offered by the institution. Accordingly, one can think that this result is related to the Turkish culture and the fact that we have a high sense of belonging socially-emotionally. Similarly, native characteristics within the framework of the facilities presented by the digital age might have been effective in this result.

Gender

The results based on t-test for gender groups show no significant differences between acceptance and usage of Cloud Computing Systems (CCSs) between gender groups in Turkey. It is obvious that this result will be interpreted positively for Turkey which is a developed country according to Human Development Indices (2018), and it is possible to say that this result regarding the gender on the basis of development contributes substantially to the literature. Because no study directly addressing gender in this regard was observed in the literature. However, one should remember that this result achieved in Turkey stems from the students of different departments in one faculty. Because students of the same faculty would have similar experiences about the technology usage in education-instruction.

It is apparent that the abovementioned policies based on the levels of development indicate the indispensable nature of technology and the obligation of rapid adaptation and that addressing CCS within the context of TAM3 will contribute to the rapid adaptation process; indeed, TAM3 involves psychological factors effective in individual acceptance and usage of technology.

The Results about United Kingdom

The lowest, middle, and the highest dimensions about CCSs in United Kingdom

As in Turkey, in UK, Image (IMG) dimension of the Cloud Computing Systems (CCSs) had the lowest score in comparison to other dimensions. Whereas UK is in the category of developed countries compared to Turkey, this situation arguably did not change the average answers given by the students in regard to the IMG dimension. Similarly, the fact that the participants are from the digital native and digital immigrant generations and they did not have the technological competence that could affect their IMG perceptions in social effect processes might have been effective in this result. Likewise, considering the teachers with doctoral degree and the different generations of students in UK, the result is arguably meaningful.

Differently from Turkey, in UK, Subjective Norm (SNORM) dimension had a moderate score compared to other dimensions. Subjective norm is described as "how people who are important to an individual think that the individual should use the system" (Fishbein and Ajzen, 1975; Venkatesh and Davis, 2000), and Venkatesh and Davis (2000) address subjective norm in the category of social effect processes and cognitive tools within the theoretical framework of technology acceptance. Accordingly, one can think whether this is a characteristic of the institution's culture or not. Moreover, the fact that universities in UK are not free of charge is thought to be effective in this result. It can be argued that this result is significant since paid education is important for students and this might be associated with their extrinsic motivation. It is possible to say that the teachers important to the students had moderate scores of perceived subjective norm to enable the students to think of themselves positively.

Lastly, Computer Self-Efficacy and Perceived External Control (CSE-PEC) had the highest score in UK as in Turkey. Similarly, when facilities were offered to the students, CSE-PEC dimension related to the acceptance of Cloud Computing Systems (CCS) had high scores. This result is arguably associated with the fact that the participants' skills required by the digital age are supported with external resources. In addition, according to this result, CSE and PEC which is effective in technology acceptance that has important pedagogical foundations in service to technology integration can be associated with external barriers (Hamutoglu and Basarmak, 2020). In fact, considering Venkatesh's (2000) definition of CSE and PEC, it is possible to argue that barriers to technology integration can be pedagogically prevented once individual's self-efficacy is integrated with the infrastructure presented to him/her.

Gender

In UK, it was found significant difference in terms of Computer Self-Efficacy and Perceived External Control (CSE-PEC), Subjective Norm (SNORM), and Output Quality and Demonstrability (QOUT-DEM) components and total score of the scale, and males in have more responses than females on these components. While this result paves the way for the fact that the difference between women and men in UK which is a developed country seems to be contradictory, it can be argued to be meaningful. Indeed, given that Middlesex University in UK is a cosmopolitan university, many of the students may be from different countries. Even though their instructional culture has the capacity to compensate different characteristics, when it comes to technology usage, one can say that past experiences (technology ownership, internet ownership, socio-economic status, etc.) can cause difference in terms of gender. In fact, no directly gender-based study in this subject matter was observed in the literature. This result of the study will obviously contribute to the literature in this sense.

The Comparative Results for Turkey and United Kingdom

The dimensions about CCSs

Regarding the technology acceptance achieved in the dimensions of Cloud Computing Systems (CCSs) acceptance scale, there are sociocultural differences between Turkey and UK. Indeed, the students in UK were found to have higher scores in the dimensions of Perceived Usefulness (PU), Perceived Ease of Use (PEU), Computer Self-Efficacy and Perceived External Control (CSE-PEC), and Relevance (REL) than the students in Turkey, which can be explained as follows: It is seen that how a student studying in UK adapts technology is associated with PU, which can be explained by the effects of the different characteristics of Eastern-Western societies on acceptance (Lee, Kozar and Larsen, 2003). While it seems that a different finding was achieved for PEU, it is recommended to interpret this finding by exploring the origins of participants in future studies. Similarly, UK had higher scores in the dimensions of CSE-PEC and REL than Turkey. It is therefore possible to argue that relation with one's job had significantly higher scores in terms of the acceptance of a technology for the students studying in UK.

On the other hand, the dimensions of Computer Anxiety (CANX) and Image (IMG) had significantly higher scores among the students studying in Turkey. Accordingly, it is possible to say that anxiety over technology usage is effective in acceptance for the students in Turkey; indeed, Hamutoglu and Basarmak (2020) state that this might be related to internal barriers to technology integration. Finally, Turkey's significantly higher score in the IMG dimension can be interpreted socially-emotionally.

About gender

Females in UK have higher responses on components Perceived Usefulness (PEU) and Perceived Enjoyment (PENJ) compared to Turkey. In contrast with the difference between the Eastern-Western societies argued by Lee, Kozar and Larsen (2003) about perceived ease of use, it is thought that this result of the study is related to the different educational culture and social life in Sakarya University. Females in Turkey are highly responsive on components Computer Playfulness (CPLAY), Computer Anxiety (CANX), and Image (IMG) compared to UK females. This result might be associated with the fact that the students studying in Turkey became acquainted with technology later. Male participants from UK responded highly on components Perceived Usefulness (PU), Perceived Ease of Use (PEU), Computer Self-Efficacy and

Perceived External Control (CSE-PEC), Perceived Enjoyment (PENJ), Subjektive Norm (SNORM), Relevance (REL), and Output Quality and Demonstrability (QOUT-DEM) compared to males from Turkey. In this context, TR male participants' scores are higher than their UK counterparts. This result can be explained by the effect of countries' development parameters within the context of education's social and cultural scope.

CONCLUSION

This study is based on a comparison between the students studying at Middlesex University (UK) and Sakarya University (TR), on the acceptance and usage of Cloud Computing Systems (CCSs) within the framework of TAM 3. One of the main findings of this study is the distinction between the universities in the way of their perception on Computer Anxiety (CANX) in their own educational-culture of each institution context (for instance the way the institution accepts and integrates new technology and teaching practices). Furthermore, the participants' perception on the Image (IMG) component has the lowest scores of all of the components of TAM 3 in both countries. In the light of the results, it can be said that there is no similar findings in literature because the cultural comparison of IMG in the framework of TAM 3 has not been directly focused yet.

According to classification for low, medium, and high on the acceptance and usage level of the participants, IMG is the lowest among other components at Middlesex and Sakarya University, respectively. These findings show that the participants' perception of IMG is very low on the acceptance and usage of the CCSs. Venkatesh and Bala (2008) argue that IMG has a significant impact on the students' future usage of the technologies. According to Moore and Benbasat (1991), image is the perception of the usage of an innovation which raises the social status of the individuals in a social system. According to that, this result shows that IMG plays an important role in the integration of technologies into education. Furthermore, it is believed that using technology in the classroom will impact on the students' beliefs, attitudes etc. This finding may help improve the effective use of technologies, and better planning of activities to enhance the participants' perception on the acceptance and usage of technologies.

The findings of the study show that Computer Anxiety (CANX) has a different ranking compared to other dimensions in each university. According to the results, CANX shows significant differences between Middlesex and Sakarya University. Furthermore, it is important to note that although the participants use similar technologies, the responses regarding CANX are higher in TR compared to the UK. This means that the participants in TR have more computer anxiety. The reason could be based on the cultural differences. Rahimi and Yadollahi (2011) found in their study conducted in east culture that computer anxiety is negatively related with the ICT integration. Computer anxiety may relate to the level of development of a country and hence differ between the East and the West. Shortly, even though computer anxiety is negatively related at a high rate with the perceived ease of use, it is seen that this situation is related with the individuals' experiences on the system (e.g. Howard and Smith, 1986; Igbaria, Guimaraes and Davis, 1995; Igbaria, Parasuraman & Baroudi, 1996; Thompson, Higgins & Howell, 1994). In summary, the computer anxiety of the individuals decreases after having experience on the system (Igbaria and Chakrabarti, 1990; Liu, Reed and Phillips, 1992).

The results of the comparative study show there is a significant difference in Perceived Usefulness (PU), Perceived Ease of Use (PEU), Computer Self-Efficacy and Perceived External Control (CSE-PEC), Perceived Enjoyment (PENJ), Subjektive Norm (SNORM) and Relevance (REL) between groups, and is responded highly by the UK participants. Furthermore, Computer Anxiety (CANX) and Image (IMG) components have a significant difference as well, and TR participants are responded higher compared to UK. As also stated above, this situation might stem from the cultural differences between the East and the West.

Also, there is a significant difference between females in both groups, females in the UK group have higher responses on components Perceived Ease of Use (PEU) and Perceived Enjoyment (PENJ) compared to females in the TR group. In addition, the responses of the females in TR are higher on Computer Playfulness (CPLAY), Computer Anxiety (CANX), and Image (IMG) components compared to the UK. Furthermore, there is also a significant difference on the Perceived Usefulness (PU), Perceived Ease of Use (PEU), Computer Self-Efficacy and Perceived External Control (CSE-PEC), Perceived Enjoyment (PENJ), Subjektive Norm (SNORM) and Relevance (REL), Computer Anxiety (CANX) and Output Quality and Demonstrability (QOUT-DEM) components of TAM3 amongst females in each group. Only the exception of Computer Anxiety (CANX) is responded highly by females in the TR group compared to the females in the UK group. Liu and Guo (2017) discuss in their study that gender has a significant difference on the acceptance of mobile computing devices among college students.

Finally, there is a significant difference in the Computer Self-Efficacy and Perceived External Control (CSE-PEC), Subjektive Norm (SNORM), and Output Quality and Demonstrability (QOUT-DEM) components between males and females in the UK. In addition to this, the analysis of the results show that there is not any significant difference between males and females in TR.

It is worth to note that there is no invariance which stems from linguistic differences between the two groups. Chen (2007) suggests that changes in RMSEA and CFI show the invariability of the groups. All models -configural, metric, scalar, residual, and structural- of invariance are established, as indicated by the results of linguistic measurement invariance in both groups.

In summary, this study is a comparison of the acceptance and usage of CCSs between UK and TR groups of higher education students within the framework of TAM 3. The roles of gender and cultural differences in the use of technology indirectly is reported in the literature (Li and Kirkup, 2007; Cai, Fan, and Du, 2017; Makrakis, 1992). Collis and Williams (2001) discuss that cultural differences are essential factors on the individual's acceptance of technology. However, there is no findings which clearly show the acceptance and use of Cloud Computing Systems (CCSs) with socio-cultural differences.

Limitations, and Recommendations for further Studies

Although the result achieved in terms of gender variable in the study is considered positive for Turkey, one should remember that the data in the study were collected from the students attending different departments of one faculty. Given that students come from different cultures during these times in which mobilization is very important, it is thought that the result achieved in the study is not related to the cultural values of a society but the socio-cultural context of both educational institutions included in the study. One possible interpretation of this result is that there is no significant difference in the acceptance of new technologies and their integration into educational processes by gender for educational institutions. Future studies with larger samples can reinforce the sociocultural discussion of these study result.

Furthermore, it is emphasized in the study that the past experiences of the students are important in terms of gender in the case of Middlesex University, and it is recommended to examine students' technology ownerships and origins in future studies on individual use and acceptance of technology.

This study could lead to the identification of the deficiencies of the acceptance and usage of CCSs in higher education and may help based on the findings obtained for gender and other sub-dimensions of TAM 3, and provide learning activities to increase the acceptance and usage in their educational and cultural context.

The study provides insight into further enhancing students' satisfaction and use of technologies in learning through correct choices of technology usage in the light of within the socio-cultural context of educational cultural and gender differences to meet students' expectations.

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Declaration

Availability of data and material

Not applicable.

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Statements on open data and ethics

This research was carried out considering the ethical guidelines. The participants consist of university students and they participated in the study voluntarily. The participants were informed about the privacy of the study and their names were not taken. The views taken from the participants do not match with any of their demographics ensuring that they are not being disadvantaged.

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List of Abbreviations

Perceived Usefulness: PU

Perceived Ease of Use: PEU

Computer Self Efficacy-Perceived External Control: CSE-PEC

Computer Anxiety: CANX

Perceived Enjoyment: ENJ

Subjective Norm: SNORM

Image: IMG

Job Relevance: REL

Output Quality and Result Demonstrability: QOUT-RES

Computer Playfulness: CPLAY

United Kingdom: UK

Turkey: TR

Technology Acceptance Model 3: TAM 3

Information and Communication Technology: ICT

Cloud Computing Systems (CCSs)

$\chi 2$/SD: Chi-square/standard deviation

CFI: Comparative fit index

GFI: Goodness of fit index

AGFI: Adjusted goodness of fit index

RMSEA: Root Mean Square Error of Approximation

SRMR: Standardized Root Mean Square Residual