Review of Management and Economic Engineering
Vol. 23, No. 3(93), September 2024, p. 244 - 252, ISSN (print): 1583-624X, ISSN (online): 2360-2155

THE USE OF INNOVATIVE E-LEARNING TOOLS IN TECHNICAL EDUCATION IN CLUJ COUNTY, ROMANIA

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Abstract: This study aims to analyze the influence of previous experience with IT tools and access to these tools on the effectiveness and continued use of online platforms in Romanian technical education, particularly in Cluj County. It also evaluates the current use and adaptation to e-learning platforms post-pandemic. A questionnaire was administered to 79 teachers and 352 students from the Technical University of Cluj-Napoca and vocational schools in Cluj County. The data collected was analyzed using descriptive and inferential statistical methods, including the t-test for comparing means. The results indicate a positive influence of previous experience with IT tools on the effectiveness of online learning. Access to IT tools has also had a positive impact on the utilization of online platforms. While online platforms continue to be utilized, there are significant reservations regarding their effectiveness for practical skills acquisition. The study suggests that a hybrid learning model combining online and traditional methods could maximize educational efficiency.

Keywords: e-learning, IT tools, online platforms, technical education system

1 INTRODUCTION

The concept of "education" has naturally evolved over time and has undergone significant changes, especially in recent years, with the emergence of Education 4.0. Due to the use of technology, computers, and the Internet, Education 4.0 has opened new perspectives. The future will belong to Education 4.0, and the transition towards it requires the development and harmonization of educational systems through a new type of relationship between student-teacher-technology = smart education and the use of online, electronic tools (Boca, G.D., 2021).

Although the term "e-learning" was not recently introduced in the specialized literature (Hargitai, D.M., Pinzaru, F., Veres, Z., 2021), the use of various "e-learning" methods has seen a tremendous increase in the context of the Covid-19 pandemic.

According to the Cambridge dictionary, e-learning, that is electronic learning is „the business of providing courses online for students so that they can study and learn from home". The specialized literature has refined this definition, so according to some authors (Harghitai et al., 2021), the general meaning of this notion consists of any electronically available learning method and includes a wide range of computer-based educational platforms, educational material sharing methods, and forms of educational materials. According to (Kahiigi, E.K., Ekenberg L., Hansson H., Tusubira F.F., Danielson M., 2008), e-learning represents the acquisition of knowledge and skills by employing electronic technologies such as computers and the Internet. According to other authors (Koohang & Harman, 2005; Cohen & Nycz, 2006), e-learning involves delivering education (comprising all activities related to instructing, teaching, and learning) via diverse electronic media. It serves as the contemporary technological response to aligning the specific learning needs of a group of learners with the content they need to learn, utilizing a defined set of learning tools. According to (Marunevich, O., Kolmakova, V., Odaruyk, I., Shalkov, D., 2021) e-learning is an active application that uses multi-purpose electronic devices, Internet, intranets/extranets, interactive TV or satellite broadcast in order to deliver educational content and establishes the cooperation between the participants of the learning interaction.

The online education system was evidently used before but especially during the pandemic in Romania, both in pre-university and higher education. The e-learning system is relatively young in Romania, with its foundations laid approximately 20 years ago. Over time, most universities have increasingly started to use e-learning platforms (Tudorache, P., 2020).

2 AN OVERWIEW OF THE E-LEARNING TOOLS USED IN THE ROMANIAN EDUCATIONAL SYSTEM

According to the literature (Bezhovski, Z., Poorani, S., 2016), electronic learning, considered as computer-assisted learning, appeared in the 1960s. However, its adoption and popularization began after the popularization of the Internet and the Web. The online learning process has been referred to in various ways in the literature: Computer-mediated learning (Anaraki, F., 2004), Web-based training, E-learning systems, and Learning Management Systems (Costa, C., Alvelos, H., Teixeira, L., 2012). However, despite the diversity of names, these systems are equipped with the same features that allow the recording and evaluation of students' activities, facilitate course delivery, and enable interaction between students and teachers (Costa C. et al., 2012), (Coman, C., Țîru, L.G., Meseșan-Schmitz, L., Stanciu, C., Bularca, M.C., 2020). In terms of student-teacher interaction, it has been shown that in the online educational context, communication between students and teachers can be both asynchronous and synchronous (Kearns, L.R., 2012). Asynchronous communication allows information and messages to be viewed by recipients at their convenience, while synchronous communication occurs in real-time with all participants logged in simultaneously (Tartavulea, C.V., Albu, C.N., Albu, N., Dieaconescu, R.I., Petre, S., 2020). According to Bezhovski, tools that facilitate the transmission and distribution of e-learning content can be divided into two categories: asynchronous learning tools, such as reading materials, audio and video, and forums, and synchronous learning tools, such as virtual classrooms, webinars, video conferencing, and similar methods. The e-learning system is complex and includes various elements such as IT tools and design, e-learning

platforms, content, and participants (Cohen, E., Nycz, M., 2006). An important feature of this learning method is its versatility and flexibility, as it offers teachers and students the opportunity to access and share different learning materials including MS Word, PDF, PPT slideshows, audio, and videos for educational purposes (Marunevich, O. et al., 2021). With the ongoing changes in education, especially in higher education, universities must keep pace with the desires, requirements, and needs of students (Coman, C. et al., 2020). According to some authors (Fischer, H., Heise, L., Heinz, M., Moebius, K., Koehler, T., 2014), one of the main challenges universities face in this era of technology is the integration of innovative e-learning systems to reinforce and support both the teaching and learning processes. In Romania, educational platforms have been utilized in universities and schools to support distance learning activities through features such as Resources, Assignments, Messages, Tests, and Chat (Răducu, C.-M., Stănculescu, E., 2021). However, during the Covid-19 pandemic, "meetings" were introduced for all teaching activities for the first time (Marchis, G., 2020). Romanian universities have educational platforms that are generally based on well-known LMS platforms like Moodle or those created by Microsoft and Google (Edelhauser E., Lupu Dima L., 2020).

3 THE BENEFITS AND DISADVANTAGES OF THE E-LEARNING TOOLS

Extensive and diverse studies have highlighted both the advantages and disadvantages of this type of learning. Numerous benefits have been identified in the specialized literature (Kizilcec, R.F., Reich, J., Yeomans, M., Dann, C., Brunskill, E., Lopez, G., Turkay, S., Williams, J.J., Tingley, D., 2020), (Butler, K.C., 2012), (Gupta, S., Eastman, J.K., Swift, C.O., 2005), (Basilaia, G., Kvavadze, D., 2020). During the Covid-19 pandemic, online learning enabled students to continue their studies and teachers to work remotely. Navarro and Shoemaker (2000) found that the e-learning system allowed students to comprehend and assimilate concepts as well as, or even better than, traditional learning methods. The system's effectiveness was also valued by students who were shy or had learning difficulties, as they often lacked the confidence to speak in front of their peers and teachers in face-to-face settings (Stern, B.S., 2004). Additionally, the flexibility and accessibility of delivering and accessing educational content and learning resources were highlighted as significant advantages (Bakia, M., Shear, L., Toyama, Y., Lasseter, A., 2012). Among the advantages of online courses are their dynamic nature, convenience, inclusiveness at any time, and the simplification of teaching (MacPhee, L., Shelley, E., Karcz, G., 2003).

Another significant benefit of educational platforms used in e-learning is the diversity in terms of assessment, as teachers have the opportunity to place continuous or summative assessment tests (Boca, G.D., 2021). According to other authors (Li, B., Guan, Q., He, Z., Luo, W., and Zhu, X., 2021), an advantage of online education is increasing the possibility of learning opportunities, improving student self-learning abilities and skills, at each student's own pace (Coman, C. et al., 2020).

Other mentioned advantages include the speed of information delivery, efficient communication between teachers and students, particularly in coordinating thesis/dissertation projects, the ability to present much more complex materials and disseminate them quickly during teaching activities, higher student attendance, acquiring new teaching skills and interaction with students (Morar, D.E., Ciplea, S.A., Sucala, D., 2023), development of digital competencies (Kerres, M., 2020), as well as lower costs (Muruthy, A.E., Yamin, F.M., 2017; Chowdhury, F., 2019).

Researchers Leisi P. and Hongbin W. (2019) have conducted extensive comparative studies on the effectiveness of traditional versus online

learning methods in undergraduate medical education. Their findings showed that, regardless of the statistical method used, online learning methods were not less effective than traditional (offline) ones. The same authors acknowledged that the e-learning system offers distinct advantages and could serve as a viable learning method in medical education. Additionally, the use of educational platforms in medical education has allowed for the identification of innovative teaching methods and tools (Chatterjee I., Chakraborty P., 2021).

According to Becker et al. (2017), e-learning platforms have a crucial feature: they allow for the storage and management of an unlimited number of courses, as well as an unlimited volume of content within a course.

Conversely, several factors can undermine the efficacy of the e-learning system, hindering online learning. These include academic skills, learner motivation, administrative challenges, social interaction, technical proficiency, time management and study support, technical issues, costs, and internet accessibility (Muilenburg & Berge, 2005). These barrier factors have been identified in studies and researches regarding the disadvantages of e-learning.

According to Ionescu et al. (2020), "teachers consider the biggest disadvantage of the e-learning system the need to adapt the courses to the new teaching conditions, but also the student evaluation system in the online environment, as well as the low efficiency of the accumulation of new knowledge by students." For students, the main dissatisfaction was the lack of student–teacher interaction, lack of socialization with colleagues, and also a perceived lower level of teaching quality.

Other identified disadvantages include students' refusal to participate in classes with their camera on, citing privacy concerns, which is also the reason why their ability to assimilate information during online classes was low (Edelhauser, E., Lupu Dima, L., 2021). Some teachers felt the need to increase the interactivity of the courses (Gherhes, V.S., Simon S., Para I., 2021). Students' well-being has been negatively affected due to frustrations, boredom, and anxiety related to their academic activities, as well as some students' lack of confidence in using online teaching platforms (Doolan et al., 2021). Additionally, notable challenges include the absence of suitable assessment methods for students in the online environment (Cicha, K.; Rizun, M.; Rutecka, P.; Strzelecki, A., 2021), digital disparities among students, and the necessity for both teachers and students to have computer literacy when utilizing educational platforms (Boca, G. D., 2021). Despite the disadvantages of online education, which cannot be ignored, one of the prevailing ideas in the literature is that the significant benefits offered by this type of learning merit exploration and improvement (Goldbach, I.R., Hamza-Lup, F.G., 2017; Edelhauser E.; Lupu Dima L, 2020; Limbasan, I.G., 2021).

4 UTILIZING QUESTIONNAIRES IN ANALYZING SPECIFIC TEACHING-LEARNING-EVALUATION METHODS IN ROMANIAN TECHNICAL EDUCATION AND INTERPRETING THE RESULTS OBTAINED FROM THEIR APPLICATION

Objectives:

Objective 1: Examine how prior experience with IT tools impacts the effectiveness of online learning.

Objective 2: Assess how access to IT tools influences students' use of online platforms.

Objective 3: Review the current utilization of online platforms within the technical education system.

Hypotheses:

Hypothesis 1: Prior experience with IT tools positively impacts online learning.

Hypothesis 2: Access to IT tools positively influences the use of online platforms.

Hypothesis 3: Online platforms continue to be used in the technical education system.

Sample:

The questionnaire was administered to 79 teachers: 41 from Technical University of Cluj-Napoca and 38 from nursing schools; and 352 students: 78 from Technical University of Cluj-Napoca and 274 from nursing schools in Cluj County. Most of them (74,01%) come from urban areas and 25.99% from rural areas.

Instruments:

Based on the main deficiencies identified in online education, we have developed a questionnaire addressed to teaching staff at vocational schools, professors at the Technical University of Cluj-Napoca, and their students. The questionnaire aims to assess respondents' perceptions regarding the effectiveness of online education, adaptation to online learning, access to and familiarity with IT tools, and the post-pandemic utility of educational platforms.

Interpretation of questionnaires:

Descriptive Analysis:

Following the administration of the questionnaire, the main educational platforms used during online education were identified: Google Classroom (37,82%), Zoom (31,55%), Microsoft Teams (25,99%), and Adservio (2,55%).

Regarding the participation of teaching staff in training courses for using the educational platform, it is noted that only 39.2% of respondents benefited from these courses, compared to 60.8% of respondents who did not participate.

Statistical Analysis - Comparison of Means:

The statistical analysis and interpretation of the results were conducted using the IBM SPSS Statistics 20 software.

The independent variables considered in this research are:

- Respondents' category, with two modalities: teaching staff and students;
- Residential environment, with two modalities: urban and rural;
- Status of teaching staff, with two modalities: faculty teaching staff and vocational school teaching staff.

The t-test was used to capture differences between the ratings of respondent groups.

Access to IT resources is essential for the effective use of online platforms. The study shows that there is similar access to IT resources between rural and urban environments, but respondents from urban areas are more likely to purchase IT equipment from their own funds ($t=2.022$, $p=0.022$). This difference highlights the need for support policies and investments in IT infrastructure to ensure equitable access to technological resources and to improve the effectiveness of online education.

Both teaching staff and students reported a high level of familiarity with IT tools before the implementation of online education, which facilitated the transition and adaptation to this environment. No significant differences were identified between groups ($t=0.455$, $p=0.875$), suggesting that previous experience with technology had a positive effect on online learning. This highlights the importance of digital skills as an essential factor for success in modern education.

Responses regarding the effectiveness of online education are mixed. Teaching staff show more reluctance than students to consider this format as equally effective for teaching specific subjects ($t=1.940$, $p=0.026$). This suggests a slight tendency for teaching staff to underestimate the effectiveness of online education compared to students. The study identified significant differences in the perception of grades achieved during online education between teaching staff and students. The study revealed significant differences in the perception of grades obtained during online education between teaching staff and students. Specifically, teaching staff rated their grades with an average of 2.27, while students rated their grades at an average of 2.66. This difference is supported by a t-test indicating statistical significance ($t = -4.182$, $p < 0.001$). There

is a statistical difference between the responses of teaching staff and those of students regarding the level of skills acquired during online education; thus, students consider the level of skills acquired during online education to be comparable to that of face-to-face education (t=2.439, p=0.008). This suggests that students are more optimistic about their level of acquired skills and the accuracy of grades obtained compared to the assessment of teaching staff.

Furthermore, practical classes are not considered suitable for online delivery (t=2.587, p=0.005), while theory classes are more suitable for online education (t=2.813, p=0.003). These responses underscore the need for a hybrid approach that combines online and traditional education, adapting to the specific needs of each discipline.

Independent Samples Test					
	t-test for Equality of Means				
	t	df	Significance Two-Sided p	Mean Diff.	Std. Error Diff.
Device purchased	2.022	429	.044	.110	.054
Familiarity with IT tools	.455	429	.649	.049	.107
Online education - efficient alternative	1.940	429	.053	.295	.152
Grades reflect the level of knowledge	-4.182	429	<.001	-.399	.095
Students' acquired level of skills	2.439	429	.015	.363	.149
Practical classes online	2.587	429	.010	.391	.151
Theory classes online	2.813	429	.005	.458	.163

The overall data show that both teaching staff and students were familiar with IT tools and relatively easily adapted to online education, with no significant differences between groups. Thus, the first hypothesis is validated.

Access to IT resources is reported to be similar between rural and urban areas, with a slight tendency in urban areas to purchase IT equipment from personal funds. Additionally, it is observed that online platforms continue to be used for various educational activities. Therefore, the second hypothesis is validated.

Online educational platforms continue to be used in the technical education system, even after the pandemic period. These platforms are now used for posting support materials, assignments, and for communication between teachers and students, partially validating hypothesis 3.

5 CONCLUSIONS

The current Higher Education Law no. 199/2023 regulates in Article 32, letter a), the form of organizing full-time studies, specifying that "some teaching and/or research activities within the full-time study programs can be carried out synchronously, using specific electronic, information, and communication resources, provided in the quality standards elaborated and adopted by ARACIS...". Study participants (belonging to UTCN) did not conduct teaching activities in this manner, but they used educational platforms to share support materials and post assignments/evaluations and to benefit from easier and faster communication with students and teaching staff.

In the Pre-university Education Law no. 198/2023, there are provisions regarding ensuring the exercise of the fundamental right to education, in the event of the establishment of a state of emergency, alert state, or siege state, or whenever the Ministry of Education so orders, at the request of the pre-university educational unit, with the approval of DJIP/DMBIP, teaching, learning, and evaluation activities can also be carried out online or in a hybrid system, for a specified period. A critical aspect highlighted by

the study is the limited participation of teaching staff in training courses for using online educational platforms, with only 39.2% benefiting from such training. This lack of formal preparation can negatively affect the efficiency of online teaching and learning. Therefore, there is an urgent need to develop and implement continuous training programs for teaching staff to ensure the necessary competencies in efficiently using online platforms. The grades obtained and the skills acquired during online education reflect a different perception between teaching staff and students, with a tendency for students to evaluate themselves favorably. Despite the rapid adaptation to online platforms, there are still significant reservations regarding the effectiveness of online education compared to traditional methods, especially concerning the acquisition of practical skills. Thus, a hybrid learning model is recommended to combine the advantages of both methods to maximize educational efficiency.

The continued utilization of educational platforms underscores their integration into the educational process, enhancing the flexibility and accessibility of education. This is particularly crucial in technical education, where access to diverse resources and the opportunity to learn at one's own pace are of utmost importance. Online educational platforms are now integral to a hybrid educational model, blending traditional face-to-face lessons with online instruction. This model enables swift adaptation to the diverse needs of students and the fluctuating conditions brought about by global circumstances, such as emergency situations.

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