


## Examining Technology Use and Competence of Higher Education Academics During the COVID-19 Pandemic


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### Abstract

**Objectives:** The present study describes the utilization frequency and competencies of educational technologies among academics at a university in Turkey during the COVID-19 pandemic.

**Methods:** Participants were 391 faculty members and lecturers working in the faculties and vocational schools of a Turkish university during the 2020–2021 academic year. A survey included questions regarding the use of educational technologies and perceived competency in the use of those technologies.

**Results:** Academics are more familiar with distance education than hybrid or blended learning. Academics reported that blended learning, hybrid learning, and distance education provide more effective education on integrating technology but report that they mostly prefer face-to-face teaching after the COVID-19 pandemic. The top three self-reported competencies are MS Office, the university academic information system, and meeting and course management tools. More information is needed about educational technology approaches and various applications such as augmented reality, simulations, assessments, and video tools.

**Conclusion:** Faculty use of digital tools is limited, they experience significant deficiencies in using various digital tools and systems, and they are less competent in applying these tools. Academics still consider traditional face-to-face teaching as the primary choice if they are free to make decisions in the context of education and training. Thus, there is a need for professional development focused on pedagogical educational technology approaches, models, and methodologies.

**Implications:** Various factors such as the course type, subject matter, education level, technical infrastructure, and technological and methodological support should be evaluated within the context of digitizing universities.

**Keywords:** *educational technologies, higher education, technology use, Web 2.0 tools*

**Date Submitted:** March 24, 2023 | **Date Accepted:** January 6, 2024 | **Date Published:** February 27, 2024

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**Note.** This research was conducted within the scope of the Transformation in Higher Education: Blended Learning Model on the Way to E-University project conducted by Istanbul Aydin University STEM Education Application and Research Center. The authors declare no competing interests.

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### Recommended Citation

Akgunduz, D., & Topalsan, A. K. (2024). Examining technology use and competence of higher education academics during the COVID-19 pandemic. *Higher Learning Research Communications*, 14(1), 19–32.  
<https://doi.org/10.18870/hlrc.v14i1.1421>

## Introduction and Literature Review

The correct use of technology and its integration into education increased in importance during the COVID-19 pandemic. Actions and strategies that accelerate the digital transformation of higher education are critical to its successful integration (Akgunduz, 2019). The global shift to digital education during the early stages of the COVID-19 pandemic revealed that most educators and students have limited experience with technological approaches, making it urgently necessary for educators to be trained in technological pedagogical domain knowledge (Hebert et al., 2022; Lockee, 2021). Higher education institutions need to solve the problem of adapting to changes in digital education by developing technological tools and strengthening the technological infrastructure (Akgunduz et al., 2021; Burkholder & Krauskopf, 2021a; Polhun et al., 2021; Vlachopoulos, 2022).

Higher education institutions have sought to provide new technologies to staff, faculty, and students (Aldahdouh et al., 2020); however, this does not mean that academics and students will use them (Kirschner & Karpinski, 2010). Researchers have increasingly suggested that educational technology software and tools are oversold but underutilized (Manca & Ranieri, 2016). There has been significant research on whether technologies can contribute to the learning process (Backfisch et al., 2021; Mei & Symaco, 2021; Piyatamrong et al., 2021; Shirish et al., 2021; Yu & Nazir, 2021). To optimize the use of available technologies, it is essential to understand the frequency of usage and the proficiency level of users (Turel & Johnson, 2012). Veletsianos and Kimmons (2013) posited the need to investigate profiles of technology users; doing so can elucidate the relationship between technology use and the educational level, age, discipline, gender, and other personal characteristics of staff.

### Higher Education and the Use of Technology

Most studies on technology use in higher education involve students. Reflections on the readiness level of lecturers and the skills they need to develop are not common; many studies related to this were carried out during the COVID-19 pandemic. Qualitative studies conducted during this period compared face-to-face and online education (e.g., Bao, 2020; Huber & Helm, 2020; Moorhouse, 2020). Barbu et al. (2022) found that faculty members, lecturers, and students have difficulty using and understanding educational technologies. Piyatamrong et al. (2021) posited that the inadequate incorporation of technology into the educational process can impede the teaching and learning process, dampen enthusiasm, and even negatively impact academic outcomes. Consequently, Piyatamrong et al. (2021) suggested that educators in higher education ought to restructure their technological pedagogical practices by leveraging innovative technological tools to facilitate effective learning. They also cited students as often being disappointed with their experience of online learning activities during the pandemic; one reason for this was that lecturers only taught traditionally and used technological tools to ensure effective learning. The inadequacy of academics regarding the use of technological approaches and tools makes it difficult for students to adapt to learning in a developing higher education environment.

Aldahdouh et al. (2020) examined the way academics use social media, devices, and cloud computing services. Results show that women in academia adopt technological tools and academic social networking sites earlier and use them more effectively than men. Maphalala and Adigun (2021) conducted research with South African university academics on the use of e-learning and technology to support teaching and learning and recommended that universities update their e-learning platforms with new technologies, provide technology training, and provide timely technical support. Nikou and Aavakere (2021) argued that while

digital technologies are fundamentally transforming teaching and learning in higher education settings, the pace of this technological change is challenging for academics. Researchers suggest that to understand the changes taking place in the higher education environment, more attention should be paid to the redefinition of policies and strategies that will increase the willingness of individuals to use digital technologies (Lea & Jones, 2011). Universities must devise digital learning methodologies and provide digital learning tools and support systems to fortify the learning process (Krishnamurthy, 2020). Considering the challenges encountered during the digital transformation of higher education, Garcia-Morales et al. (2021) suggested that universities prioritize the digitalization of learning processes while providing specialized technical education to professors, administrative staff, and students. Scherer et al. (2021) recommended that universities develop strategies to facilitate capacity building in institutions. Elfirdoussi et al. (2020) found that professors over the age of 50 have difficulty following the technology; that they mostly use Moodle, Microsoft Teams, Zoom, and Google Classroom as distance education platforms; and that they mostly give homework and practical tasks to evaluate students during distance education.

In general, the results of all these studies reveal the necessity of updating the technological field knowledge amidst the digital transformation of higher education institutions. Digital transformation has become a priority for higher education institutions that claim to be leaders of change and highly competitive in their domains. If higher education wants to persist in time as a key element of this transformation and not disappear from the stage, it must evolve integrally (Benavides et al., 2020).

### **Technology Tools Used in Higher Education**

The adaptation of technology to education requires a systematic and organized effort to increase tools while also increasing the quality of education. Digital education requires the effective use of appropriate infrastructure and technological platforms, such as Blackboard, Moodle, and Microsoft Teams (Castro & Tumibay, 2021; Zamora-Antuñano et al., 2021). Proficiency in contemporary technology and the effective implementation of technological pedagogical field knowledge to support the teaching process necessitate technology education. Available technological resources afford numerous options for teaching, including video conferencing for lectures, material sharing (e.g., slides, videos, presentations), interaction through chats, creation of discussion forums or study groups, supervision of practical activities, evaluation and instruction of students, and recording of explanations. Furthermore, these tools can be employed synchronously or asynchronously and integrated into learning management systems as well (Camilleri & Camilleri, 2022). Microsoft Office or Teams are examples of resources that enhance virtual communication (Mishra et al., 2020).

Dudar et al. (2021) listed several tools commonly used in teaching and learning contexts throughout European countries. These include e-mail, Google Drive, Moodle, Zoom, Webex, and Google Classroom. Zoom and Webex platforms are preferred for online seminars. Online practice tools include e-mail, Google Drive, Moodle, Google Classroom, and the Microsoft Office suite programs. For assessments and assignment completion, tools included e-mail, Google Drive, Zoom, Google Meet, and Microsoft Office programs. Communication tools included Viber, Telegram, WhatsApp, and Imo. Dowling-Hetherington et al. (2020) found that the technology tools identified by students as best supporting their learning include Google Drive as a virtual learning environment and online video source; Whatsapp as the means for communication; Prezi, Slideshare, and Canva as software tools for presentations and visual programming; OneNote as a note-taking tool; and Kahoot and Mentimeter as measurement and evaluation tools. Mishra et al. (2020) found that from the perspective of faculty in India, academics use WhatsApp, Telegram, and e-mail to increase interaction; Zoom, Cisco, WebEx, Google Meet, or Skype to teach online; and YouTube to record their lectures as teaching over web mode. In Turkey, the most frequently used synchronous tools reported were Zoom, Microsoft Teams, Perculus, and Adobe Connect. Asynchronous tools identified for use in education were Moodle, ALMS, Google Classroom and Microsoft applications (Durak et al., 2020; Kacan & Incoming, 2020; Yavuz et al., 2020).

## Purpose of the Study and Research Questions

In this context, we identified several research questions for investigation involving higher education academics.

1. Which pedagogical approaches, methods, and techniques do academics think would be knowledgeable and useful in technology integration?
2. How often do academics use technological tools and what are their competencies in using them?
3. What are academics' professional development needs regarding technology integration?

Therefore, the purpose of the study was to investigate the frequency of use of various educational technology tools and the perceived competencies of academics teaching at a university in Turkey during the COVID-19 pandemic.

## Method

A descriptive research design was employed, and we collected data using surveys.

### Participants

Participants included 391 university faculty members and lecturers working in all faculties and schools of a foundation university in Turkey during the 2020–2021 academic year. Ethical approval to conduct the research was granted by the university ethics committee.

### Instrumentation

To collect data, we used a Google Forms survey consisting of four sections.

*Demographics.* The first part of the survey included three questions requesting demographic information that included gender, age, and title.

*Educational Technologies.* Three questions were asked to obtain information about educational technologies. For example, one of the questions was, “Which of the following pedagogical approaches, models, and techniques do you have knowledge about concerning technology integration in education?”

*Educational Technology Frequency of Use and Perceived Competence.* Eleven questions were asked regarding competencies of academics involving technological approaches in education. Each question asked how often the tools are used by the academics, rated on a 6-point Likert scale ranging from Never to Daily; and the level of their competence in using the tool, rated on a 5-point Likert scale ranging from Not Competent to Very Competent. An example question was, “How often do you use Learning Management Systems (Moodle, Edmodo, Google Classroom, EBA, Canvas, Methodbox, Blackboard etc.)?” This was followed by, “What is your competency level in Learning Management Systems (Moodle, Edmodo, Google Classroom, EBA, Canvas, Methodbox, Blackboard, etc.)?” The final question asked about needed training. The question was, “Which of the following topics and technological tools would you like to participate in during in-service training to be provided within the organization?”

To ensure the internal validity of the survey, we sent the survey to three researchers working in the field and asked their views in a table with options such as appropriate/not appropriate/should be improved. They were also asked to provide explanations on each item when necessary. The survey was then piloted with five academics to test the comprehensibility of the questions. After the expert reviews and pilot application, it was decided that the revised survey was fully understood, and the survey was finalized.

## Data Collection

The implementation of the survey was carried out within a period of one week by announcing it to academics in all faculties and vocational schools of a foundation university. Participation was on a voluntary basis. Survey data were followed instantly, and that data was excluded in cases of incorrect data entry (e.g., duplicate entries or missing data entries).

## Analysis of Data

The SPSS V23 program was used for analyses. Descriptive statistics (frequency and percentage) of item responses were calculated for the entire sample to assess the frequency of use and competencies of academics.

## Results

### Demographics

Demographic information is provided in Table 1. Females comprised 59.3% ( $N = 232$ ) of the sample. Mean age of academics was 2.78 ( $SD = 1.31$ ), corresponding approximately to the age group of 40–49 years. Lecturers (32.50%) and assistant professors (31.50%) comprised most of the sample.

**Table 1.** Demographic Information

		<i>n</i>	%
Gender	Female	232	59.3
	Male	159	40.7
	Total	391	100.0
Age group	20–29	64	16.4
	30–39	134	34.3
	40–49	80	20.5
	50–59	52	13.3
	60 +	61	15.6
	Total	391	100.0
Title	Res. Asst./Specialist	61	15.6
	Lecturer	127	32.5
	Assist. Prof.	123	31.5
	Assoc. Prof.	26	6.6
	Professor	54	13.8
	Total	391	100.0

## Research Questions

### Research Question #1

The first research question was, “Which pedagogical approaches, methods, and techniques do academics think would be knowledgeable and useful in technology integration?” We asked academics which pedagogical approaches, models, or techniques used in education they have knowledge about. Responses are summarized in Table 2. Academics reported mostly having information about distance education (81.51%). Fewer are familiar with hybrid education (57.91%) and blended learning (39.90%) models. The frequency of those who

are knowledgeable about technological pedagogical content knowledge, remote learning, and flipped learning are quite low.

**Table 2.** *Pedagogical Approaches, Models, and Techniques of Which Academics Have Knowledge*

	%
Distance education	81.51
Hybrid education	57.91
Blended learning	39.90
Technological pedagogical content knowledge	16.79
Remote learning	12.90
Flipped learning	9.00
None	7.54
Other	1.46

We asked the question, “Which of pedagogical approach, model, or technique can be used to carry out more effective education on technology integration in education?” Table 3 provides the frequencies of responses. Academics reported that blended learning (51.85%), hybrid learning (41.12%), and distance education (38.44%) provide more effective education on integrating technology.

**Table 3.** *Pedagogical Approaches, Models or Techniques That Provide More Effective Technology Integration*

	%
Blended learning	51.82
Hybrid education	41.12
Distance education	38.44
Technological pedagogical content knowledge	16.79
Flipped learning	15.09
Remote learning	9.49
No information	8.03
None	3.65
Face-to-Face learning	0.97

We then asked the question, “If the decision on the method of teaching was made by you, how would you teach your courses?” The frequencies of the answers to the question are presented in Table 4. After COVID-19, 45.80% of the academics would prefer face-to-face teaching, and 24.60% reported wanting to continue distance education. This may indicate that academics do not yet prefer other environments and learning models.

**Table 4.** *Preferred Future Learning Models*

	%
Face-to-Face learning	45.80
Distance education	24.60
Hybrid education	14.80
Blended learning	13.60
Other	5.10

## Research Question #2

The second research question was, “How often do academics use technological tools, and what are their competencies with them?” We first asked about the technological tools they use most often. The most frequently used was MS Office ( $M = 4.61$ ,  $SD = 0.93$ ). The second most often used was the university academic information system ( $M = 4.53$ ,  $SD = 1.20$ ). Meeting and course management tools followed ( $M = 4.12$ ,  $SD = 1.04$ ). Technological assessment tools, blog tools, animation and simulation tools, and virtual reality and augmented reality (VR/AR) tools are almost never preferred.

**Table 5.** *Technological Tools Most Often Used*

	<i>M</i>	<i>SD</i>
MS Office	4.61	0.93
University academic information system	4.53	1.20
Meeting-Course management tools	4.12	1.04
Video and animation tools	2.87	1.89
Cloud computing systems	2.64	2.00
Social media	1.97	2.19
Learning management systems	1.71	1.99
Technological assessment tools	0.44	1.04
Blog tools	0.42	1.13
Animation and simulation tools	0.34	1.02
Virtual reality/augmented reality (VR/AR) tools	0.27	0.88

Note: 5 = Daily; 0 = Never

We asked respondents to rate their competency using various technology tools. The three highest self-reported competencies are MS Office ( $M = 4.14$ ,  $SD = 0.77$ ), the university academic information system ( $M = 4.14$ ,  $SD = 0.93$ ), and meeting and course management tools ( $M = 3.97$ ,  $SD = 0.79$ ).

**Table 6.** *Academics' Competencies in Using Technological Tools in Education*

	<i>M</i>	<i>SD</i>
MS Office	4.14	0.77
University academic information system	4.14	0.93
Meeting-Course management tools	3.97	0.79
Video and animation tools	3.61	1.03
Cloud computing systems	3.43	1.19
Social media	3.36	1.26
Learning management systems	2.72	1.27
Technological assessment tools	1.92	1.21
Blog tools	1.82	1.16
Virtual reality/augmented reality (VR/AR) tools	1.55	0.93
Animation and simulation tools	1.52	0.94

Note: 5 = Very competent; 1 = Not competent

### Research Question #3

The third research question was, “What are academics’ professional development needs on technology integration?” For this purpose, we asked academics which technology integration topics they would like to participate in during a professional development program. Results are summarized in Table 7. The most reported was wanting to have information about educational technology approaches, models, and techniques (55.7%). Following were augmented reality/virtual reality applications (46.2%), web-based or computer-based animations and simulations (45.3%), assessment and evaluation applications (45%), and video tools (video content creation and use of video in courses (44.3%).

**Table 7.** *Professional Development Needs*

Need	%
Educational technology approaches, models and techniques	55.72
Augmented reality/virtual reality applications	46.23
Web-based or computer-based animations and simulations	45.26
Assessment and evaluation applications	45.01
Video tools (video content creation and use of video in courses)	44.28
Learning management systems	34.79
Online meeting tools	26.76
Microsoft Office programs	24.09
Tools for online storage, sharing, and collaboration	23.84
Social media tools	22.87
University academic information system	15.33
Predetermined Web sites related to the topic	14.60
Other	4.14

## Discussion

Results revealed that academics are predominantly familiar with distance education, followed by hybrid education and blended learning. However, familiarity decreases when it comes to more specialized approaches such as technological pedagogical content knowledge, distance learning, and flipped learning. This underscores a potential expertise gap among academics on newer or more specialized pedagogical models related to technology integration. The study also explores which pedagogical approaches are perceived as more effective for technology integration. Academics identified blended learning, hybrid education, and distance learning as the most effective methods. This is in line with their reported familiarity and suggests that their perceptions of effectiveness may be influenced by their existing knowledge and experience.

Despite the increase in distance and hybrid learning during the pandemic, a significant proportion (45.80%) of post-COVID-19 academics still prefer face-to-face teaching. This trend may indicate continued adherence to traditional teaching methods or the perceived effectiveness of face-to-face interaction in certain educational contexts. Remarkably, a significant percentage (24.60%) also expressed a desire to continue distance learning, indicating a possible shift in preferences affected by the impact of the pandemic. This may also indicate a lack of proficiency in digital tools among academics. Academics generally feel more comfortable with traditional methods (Şahin et al., 2021). Related to this, Karsenti et al. (2020) found that academics limit the use of digital tools and are mostly risk-averse, managing the process with a traditional approach, which is interpreted as incompetence and lack of knowledge.



Thomas et al. (2023) found that 49.4% of participants believed that the blended learning approach is more appropriate than full digitalization, and they found that the effectiveness of the blended learning approach was 51.82%. Additionally, it is expected that hybrid models will be more widely used after the COVID-19 pandemic. Burkholder and Krauskopf (2021b) noted that hybrid models are likely to emerge, requiring a more intense focus on developing best practices and pedagogies that are acceptable to all key stakeholders in higher education.

The digital transformation of higher education has had profound consequences for educators and institutions after the COVID crisis. The impact of digital tools increased significantly at all levels of education (Núñez Canal et al., 2022). The digitalization of teaching and learning and the necessity of having qualified educators to adapt different digital learning environments to existing courses are confirmed in different studies (Al-Samarraie et al., 2018). Similarly, Sales et al. (2020) emphasized the inadequacy of faculty members in using online technologies.

Our study results show that academics primarily use common and easily accessible tools such as MS Office and the university academic information system. These tools are essential for administrative and instructional tasks and are frequently used. Meeting and course management tools are also important for facilitating communication and organizing educational content, as evidenced by their frequent use. However, unlike this study, other studies have found that academics hesitate to utilize innovative digital tools (e.g., Chick et al., 2020; Jowsey et al., 2020). Tools related to assessment, blogging, animation, simulation, and virtual reality/augmented reality (VR/AR) were found to be underutilized in the present study, indicating a potential gap in their integration into academic practice. This could be because these tools are challenging for faculty and lecturers to understand and use (Barbu et al., 2023; Covelli & Roy, 2022).

Institutions can provide comprehensive training programs that can enhance technological competencies. Hebert et al. (2022) and Lockee (2021) argued that the global transition to digital education during the early stages of the COVID-19 pandemic revealed the limited experience of most educators with technological approaches. They highlight the urgency of training educators in technological pedagogical content knowledge. Baddar and Khan (2023) also emphasized the necessity of providing adequate training and support to enhance faculty's digital competencies.

## Limitations

This study has several limitations. More in-depth analyses such as mixed-methods research can help us better understand the reasons why academics prefer various approaches and models related to educational technologies and their thoughts on returning to traditional methods after COVID-19. The results obtained in this research were conducted with volunteers who could be reached at a university. It is recommended to reach more people from different universities and different faculties. This will be more effective in generalizing the results.

## Implications for Practice

Higher education institutions should address the issue of adapting to changes in digital education by creating technological tools and improving technological infrastructure, as suggested by previous researchers (Baddar & Khan, 2023; Burkholder & Krauskopf, 2021(a); Polhun et al., 2021; Vlachopoulos, 2022). Universities should develop strategies for digital learning and provide the necessary tools and support systems to facilitate the learning process (Krishnamurthy, 2020). To achieve this, university administrations should adopt new learning environments where technology is integrated by implementing relevant educational instructions and encouraging new habits (Marković et al., 2019). Additionally, university administrations need to adopt flexible approaches to technology adoption (Gros & García-Peñalvo, 2016).

## Conclusion

Academics have been found to have limited use of digital tools, significant deficiencies in using various digital tools and systems, and less competence in applying these tools. They tend to report being familiar with technological pedagogical models and approaches such as distance, hybrid, and blended learning. It is not surprising that faculty still consider traditional face-to-face teaching as the primary choice. Thus, there is a need for professional development focused on pedagogical educational technology approaches, models, and methodologies.

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