JOLTIDA Journal of Learning and Teaching in Digital Age, 2025, **10**(2), 244-259
https://dergipark.org.tr/en/pub/joltida
ISSN: 2458-8350 (online)

Research Paper

Evaluating the Impact of an Online Course for Technology Mentors in Reverse Mentoring

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ARTICLE INFO

Received: 26 January 2025
Revised: 26 May 2025
Accepted: 06 June 2025

Keywords:
mentoring, reverse mentoring, technology mentoring, training for mentor

doi: 10.53850/joltida.1627427

ABSTRACT

For the effective use of technology in higher education, it is important to develop the technological skills of all faculty members. The Teaching and Learning Center of a state university has implemented a Technology Mentoring Program (TMP) to enhance faculty members' technological competencies and support them in using technology effectively in their courses. Although faculty participants' feedback on the TMP has been positive in the past, it was observed that students applying to be mentors in the program required additional preparation. Therefore, a Technology Mentoring Training (TMT) program was developed to address this need. This study investigated the effectiveness of TMT, a video-based online training program designed for students aspiring to become mentors in the TMP. A mixed-methods research design, incorporating both quantitative and qualitative approaches, was employed. The study group consisted of 43 students enrolled in the Technology Planning and Applications course in the Department of Computer Education and Instructional Technology. Data were collected using pre-tests, post-tests, and semi-structured interview forms. The results revealed that the TMT had a statistically significant positive impact on students' mentoring skills. Additionally, mentors reported that the TMT contributed meaningfully to their development, enhancing their effectiveness throughout the mentoring process. According to feedback from mentees, the mentors demonstrated strong mentoring competencies, particularly in communication, enthusiasm, organization, and planning.

INTRODUCTION

In the current information age, rapid changes in technology affect educational environments and teaching-learning processes. Therefore, it is crucial to learn and teach new technologies in order to adapt to the age. In the context of higher education, faculty are expected to follow technological developments, adapt to these developments and incorporate technology into teaching-learning processes (Baran, 2016; Nagy & Dringó-Horváth, 2024; Tondeur et al., 2023; Zhao, Pinto Llorente, & Sánchez Gómez, 2021). To develop these skills, professional development processes for the use of innovative tools and methods in teaching should be designed and implemented regularly (García-Morales, Garrido-Moreno, & Martín-Rojas, 2021; Marinoni, Van't Land, & Jensen, 2020; Meyer & Murrell, 2014; Nagy & Dringó-Horváth, 2024; Tondeur et al., 2023). Studies show that faculty prefer professional development programs that respond quickly to their needs, include additional training when needed to fit around their work schedules, accommodate their learning styles, and provide accessible support opportunities (Basilotta-Gómez-Pablos, Matarranz, Casado-Aranda, & Otto, 2022; Nagy & Dringó-Horváth, 2024; Stein, Shephard, & Harris, 2011). Technology mentoring can be considered as a professional development opportunity aimed at improving educators' technological knowledge and skills according to their individual needs, and examples of successful applications have been provided. It is emphasised that the role of the mentor in the process is critical to the success of technology mentoring (Clutterbuck, 2004; Klasen & Clutterbuck, 2002; Pollard & Kumar, 2021). Despite the need to design learning processes for the training of technology mentors, it is noteworthy that studies on this topic are limited and insufficient. The aim of this study was to create an online learning environment to improve the mentoring skills of individuals who will be technology mentors and to investigate the effectiveness of this environment.

In the next section, the literature on the concepts of mentoring, reverse mentoring and technology mentoring is reviewed and the skills that mentors should have are highlighted. Then, in the method section, the online learning environment developed to support these skills is explained. The implementation process of the online environment, the data obtained and the findings and interpretations from the analyses are presented.

Technology Mentoring and Reverse Mentoring

Mentoring is defined as a relationship in which knowledge, experience and thoughts are transferred from the experienced to the less experienced (Crisp & Cruz, 2009) and in which impartiality, accuracy and confidentiality are paramount (Connor & Pokora, 2012; Dorsey & Baker, 2004). In this context, mentoring is a process that enables individuals to acquire new skills or develop awareness under the guidance of experienced individuals. In this process, the mentor is the person who contributes to the development of inexperienced individuals by sharing his/her own knowledge, and the mentee is the person who improves by benefiting from the mentor's experience (Çelik, 2011). The concept of reverse mentoring emerged as a new approach that works in reverse to the traditional mentoring process (Chaudhuri, Park, & Johnson, 2022; Chen, 2013; Kişi, 2018). It is a type of mentoring where young adults provide support and information to older people (Murphy, 2012). Through reverse mentoring programs, young adults gain leadership skills and assume the role of a teacher by transferring their new knowledge and skills to older individuals (Chen, 2013; Meister & Willyerd, 2010; Murphy, 2012; Sessa et al., 2007). In addition, reverse mentoring is also referred to as an open approach that allows both mentor and mentee to share knowledge, attitudes and emotions with each other by creating a positive bond (Chaudhuri et al., 2022; Spreitzer, 2006).

Technology mentoring, on the other hand, is defined as a process in which undergraduate and postgraduate students mentor teachers to support them in using appropriate technologies that align with their purposes and needs (Pamuk & Thompson, 2009). This mentoring process is based on the assumption that younger generations, who have grown up immersed in technology, possess more advanced knowledge and experience with the latest technological tools (Busen & Engebretson, 1999; Chaudhuri et al., 2022; Frey, 2021). As such, it can be described as a form of reverse mentoring (Demiraslan Çevik, 2023).

Technology mentoring has been shown to positively influence instructors' perceptions of and efforts to use technology in their courses (Baran, 2016; Belt & Lowenthal, 2020; Corso & Devine, 2013; Demiraslan Çevik, 2023; Günuç, 2015; Kopcha, 2012; Koh, 2020; Thompson, 2008; Yu & Karakaya, 2018). Furthermore, it provides an important opportunity to support the integration of technology into the teaching process (Frey, 2021; Gökoğlu & Çakıroğlu, 2017; Kopcha, 2012; Köksal Topçu, 2025; Sánchez-García, Marcos, GuanLin, & Escribano, 2013; Top, Başer, Akkuş, Akayoğlu, & Gurer, 2021). For example, Gunuc (2015) conducted a one-semester technology mentoring program by matching Ph.D. students with faculty. The study found that time, planning, motivation, experience, personal characteristics, and matching were among the problems encountered by mentors and mentees. In addition, it was found that institutional facilities should be prepared, needs should be identified, mentor-mentee pairings should be carefully made, and the process should be managed and monitored for the effective implementation of the technology mentoring program. Baran (2016) examined the success factors and strategies that influenced the process in the technology mentoring program, in which faculty and postgraduate students were paired. According to the results, six critical strategies emerged: identifying needs, exploring the possibilities and limitations of technologies, providing guiding support, sharing feedback, connecting technology, pedagogy, and content, and evaluation. Among the success factors identified were motivation, overcoming challenges, the nature of mentoring relationships, communication channels, and support. In Demiraslan Çevik's (2023) study, it was found that both mentors and mentees gained significant benefits from a Technology Mentoring Program (TMP) in which undergraduate students taught faculty members about technology use. Faculty members reported a positive experience based on their needs, an increase in knowledge and skills in the areas they received support on during the program, and valued the students' role as mentors. Mentors similarly found the process beneficial and effective from their perspective, noting that the mentees' willingness and openness to learning, as well as the mutual open and sincere communication, facilitated the process.

As can be seen, technology mentoring is a complex, unique and multidimensional process that depends on the expectations, characteristics, competencies and opportunities of the individuals involved in the process. One of the most critical factors influencing the success of this process is the preparation of mentors for their new role (Lumpkin, 2011). The next section discusses mentoring skills and training to develop them.

Training for mentors

The aim of mentoring programs is to provide individuals with the guidance they need to develop their potential. In order to achieve this aim, it is not enough for the mentor to be an expert in the field, but they are also expected to have certain skills and attitudes. In the literature, the qualities that an effective mentor should possess include a) goal setting and planning, b) communication skills, c) modelling, d) time management, e) empathy/understanding others, f) openness to learning/self-improvement (Ard & Beasley, 2022; Balcı, 2012; Clutterbuck, 1991). Accordingly, a mentor should be patient, understanding, supportive and encouraging, use communication skills effectively, have a high attitude towards self-development and learning, plan effective time management throughout the process and monitor the status of the goals set at the beginning of the process. In order to develop these skills, it seems important for mentors to receive mentoring training. Indeed, it is emphasised that it is necessary to provide mentoring training prior to mentor-mentee matching (Garvey & Alred, 2000; Klasen & Clutterbuck, 2002; Yirci, 2009). According to Garvey and Alred (2000), the aims of mentoring training are to increase awareness of the mentoring role, to develop mentoring skills and qualities, and to make the mentoring process effective and efficient. It has been found that mentors who have received training have more effective communication skills and are more likely to share their own experiences

with mentees (Evertson & Smithey, 2000). Therefore, it has been found useful to teach behaviours such as communication, relationship and coaching skills for successful and effective mentoring (Janas, 1996). Similarly, the Wisconsin Mentoring Seminar conducted at the University of Wisconsin identified some areas of competence that mentors should develop. These are: a) maintaining effective communication, b) setting expectations for the mentoring relationship, c) assessing mentees' understanding of research, d) addressing equity and diversity in mentoring relationships, e) ensuring mentees' independence and promoting mentees' professional development (Pfund et al., 2006). At the national level, it can be seen that mentoring trainings are provided by the units of different universities (e.g. Istanbul Gedik University, Marmara University) especially for students. Within the framework of these trainings, it is noteworthy that content on topics such as the responsibilities of the mentor and the mentee, competences, the importance of dialogue in mentoring, principles of mentoring, ethical stance in mentoring, qualities of a good mentor, design and management of the mentoring process are presented. In addition, the main approaches to the delivery of mentoring training are lectures, seminars, case studies, skills practice, video material and experiential workshops (Garvey & Alred, 2000).

Mentoring training raises the awareness of individuals who wish to become mentors, supports them in effectively transferring their knowledge and skills, and equips them with the necessary strategies and tools to manage the mentoring process (Clutterbuck, 2004; Klasen & Clutterbuck, 2002). However, the achievement of these benefits also depends on how effectively the training is designed. In other words, it is essential that the objectives of the training are clearly defined, the content and process are well-structured and needs-based, the competencies expected of mentors are explicitly outlined, practical and innovative methods are employed to develop these competencies, the process is monitored, and the perspectives of both mentors and mentees regarding the effectiveness of the process are gathered. While many studies have examined the benefits of the technology mentoring process for participants and the factors contributing to its success, it has been observed that they often overlook the inclusion of mentoring training to prepare individuals for their roles as technology mentors. Yet, such training can significantly enhance the preparedness of participants—particularly those mentoring for the first time—by helping them acquire essential knowledge and skills, such as communication, teaching strategies, and time management.

The Sustainable Teaching and Learning Centre (STL) of a state university established a 'Technology Mentoring Program' for faculty to improve their technology skills and support them in using technology efficiently and effectively in their teaching activities. The program paired senior undergraduate students from the university's Computer Education and Instructional Technology (CEIT) department with faculty who wished to receive technology training, with the aim of having mentor-mentee pairs work on technology-related activities on a regular basis. In this study, an online Technology Mentoring Training (TMT) program was developed for students who will participate in the Technology Mentoring Program (TMP) run by STL and who will be mentoring for the first time. The study analyzed the effect of the training on the mentors' knowledge and skills related to mentoring. The research question and sub-problems are as follows:

What is the effectiveness of the TMT designed for undergraduate students wishing to become mentors within the TMP?
(1) Does the TMT have a significant effect on mentors' knowledge about the mentoring process?
(2) Does the TMT have a significant effect on the mentors' skills in the mentoring process?
(3) What is the opinion of the mentors participating in the TMT about the training?
(4) What is the opinion of the mentees participating in the TMP about the technology mentors and the program?

METHOD

Research Design

This study, which focuses on the effectiveness of technology mentoring training designed for undergraduate students serving as mentors in the Technology Mentoring Program run by the Teaching and Learning Center of a state university, is based on a mixed-methods research design. In mixed-methods research, qualitative and quantitative approaches are used together to obtain deeper and more comprehensive insights into the research topic, and data can be collected either sequentially or simultaneously (Lodico, Spaulding, & Voegtle, 2006). This study employed an explanatory sequential mixed-methods design. In this design, quantitative data are collected and analyzed first to identify patterns, followed by the collection of qualitative data to explain or elaborate on those findings for a more in-depth understanding. The quantitative component was structured using the "One-Group Pre-Test–Post-Test Model," one of the experimental research designs. This model involves taking measurements both before (pre-test) and after (post-test) the intervention (Karasar, 2000). To support the findings of the quantitative phase, a case study was conducted as the qualitative component. At the end of the process, the views of both mentors and mentees were gathered. Creswell (2007) defines a case study as a qualitative research approach in which the researcher examines one or more bounded systems in depth using multiple data collection tools—such as observations, interviews, audiovisual materials, documents, and reports—to identify patterns and themes. In this qualitative phase, the case was explored thoroughly to gain a deeper understanding of the mentoring experience.

Participants

The research group consisted of the students taking the Technology Planning and Applications course in the 2022-2023 academic year at the Department of CEIT of a state university and the faculty members who applied to be mentees in the TMP. As the

research was conducted during the semester, the majority of the students in the course participated. The research group consisted of 43 students who completed both pre- and post-tests measuring mentoring knowledge and skills, and 3 faculty members (mentees) who were interviewed.

Data Collection Tools

Three data collection instruments were used in this study. These are
1. Pre-test post-test: A 2-part pre-test-post-test designed to measure students' knowledge and skills about mentoring before TMT and their gains after TMT.
2. Semi-structured interview form designed to collect data including mentors' experiences and opinions after TMT and TMP.
3. Semi-structured interview form designed to collect data on mentees' experiences and opinions after TMT and TMP.

The first part of the pre-test was designed to assess students' knowledge of mentoring through a set of 30 multiple-choice questions focused on the topic of technology mentoring. During the question development process, a Computer Education and Instructional Technology (CEIT) expert initially prepared 35 multiple-choice questions related to the content. To evaluate whether the questions ensured content validity, feedback was obtained from two additional CEIT experts. Based on their feedback, the set of questions was revised to 32. Subsequently, a Measurement and Evaluation expert was consulted to assess the suitability of the questions in terms of measurement and evaluation standards. As a result of this review, 30 questions were selected for inclusion in the test. The questions were then piloted with three undergraduate students to assess their clarity, and necessary revisions were made to finalize them.

The second part included four sample scenarios of situations and problems that students might encounter in the mentoring program and aimed to measure students' mentoring skills through the solutions they would produce to these scenarios. Each scenario requires the solution of a problem related to the mentoring process through the application of the training content. The content of these scenarios was determined through interviews conducted with students who participated in the technology mentoring process in previous semesters. Students were asked about the problems and challenges they experienced during technology mentoring and what they needed to address these issues. Based on this feedback, a CEIT expert and a specialist in Guidance and Psychological Counseling collaboratively wrote the scenarios. The drafted scenarios were then reviewed by two subject matter experts to evaluate their content validity, and revisions were made based on their suggestions. Finally, the scenarios were tested for clarity by piloting them with three undergraduate students, and minor adjustments were made to finalize them. In the post-test administered after the TMT, the questions, options and scenarios of the pre-test administered to the mentors before the TMT were modified and administered again.

Semi-structured interview forms were used as the second and third data collection tools. Interview forms are used to obtain data that cannot be observed from the outside, such as the experiences, attitudes, thoughts, intentions, interpretations, mental perceptions and reactions of individuals about the subject under study (Yıldırım & Şimşek, 2008). The second data collection tool is a semi-structured interview form, which collects the experiences and opinions of the students (mentors) participating in the training and program. The semi-structured interview form is related to TMT and TMP and includes questions to determine the mentors' thoughts before these processes started, how the process was for them and what they thought after the process. The third and final data collection tool was a semi-structured interview form designed to collect data on the experiences and opinions of the faculty members (mentees) about the process and the mentors after their participation in the TMP. During the development of the interview questions, a CEIT expert initially prepared a set of questions based on the research objectives. These questions were then sent to two subject matter experts for evaluation in terms of content and appropriateness. Based on the feedback received, necessary revisions were made. Subsequently, the questions were piloted with three undergraduate students and two faculty members to assess their clarity. Following minor adjustments informed by the results, the questions were finalized.

Implementation

To evaluate the effectiveness of the TMT, a pre-test was administered to students enrolled in the Technology Planning and Applications course in the CEIT Department to assess their knowledge and skills related to mentoring prior to the training. Following the pre-test, students participated in an online Technology Mentoring Training (TMT). Delivering the training online allowed for the creation of a versatile learning resource that can be used to train new mentors each semester. The TMT consists of three modules: Academic Communication Skills, Time Management, and My Confidence as a Mentor. The Academic Communication Skills module includes three scenarios; the Time Management module includes four scenarios; and the My Confidence as a Mentor module includes three scenarios. These scenarios were developed to reflect the potential challenges mentors might face while providing technology training to their mentees. Each scenario was addressed in a dedicated video, resulting in a total of 10 videos. The videos were edited using the "jump cut" technique, taking into account the demographic characteristics of the participants. The average video length was 7 minutes, with a total training duration of approximately 70 minutes. Examples of video screenshots are presented below.

Mentors were given a total of two weeks to complete the TMT, after which access to the training was closed. At the end of the training, the knowledge and skills tests that had been administered before the training were presented again as a post-test. Students were expected to respond to the same questions and scenarios, now informed by what they had learned during the training. Following the post-test, students began their roles as mentors in the TMP, which lasted for five weeks. At the end of the TMP, a Mentor Experience Interview was conducted with five volunteer mentors and three volunteer mentees, selected through convenience sampling. Detailed information about the planned interviews was sent to the mentors and mentees via email. The interviews were conducted remotely and recorded with participants' consent.

Data Analysis

During the data collection process, a total of 43 undergraduate students completed both the pre-test and the post-test. Participants' responses to the knowledge test, the first part of the pre-test, were entered into SPSS 27.0 (The Statistical Package for the Social Sciences) by assigning values of 1 for correct answers and 0 for incorrect answers.

The second part, the skills test, was evaluated using a rubric adapted from Ge and Land (2003) to assess students' problem-solving reports for each scenario. The rubric encompassed key criteria, including clearly defining the problem, developing solution proposals, evaluating the quality of the proposed solutions, providing justification for the solutions, and referencing concepts learned in TMT as part of the problem-solving process. Scoring was determined as 0, 1 and 2 according to the scoring criteria of each criterion. To ensure reliability, the rubric was also evaluated by two independent educators with Master's degrees

in Educational Sciences. The Fleiss Kappa test was used in SPSS to determine the agreement between the three ratings. In order to interpret the agreement values in the kappa method, the levels of agreement suggested in the literature by Landis and Koch (1977) were used. The Fleiss Kappa test result for the pre-test ratings of the rubric was 0.743 and the Fleiss Kappa test result for the post-test ratings was 0.785. Both levels of agreement were found to be in the "significant level of agreement" category.
In accordance with the purpose of the study, statistical analyses were conducted for the first two research questions and content analyses were conducted for the third and fourth research questions. After entering the data from the pre-test and post-test instruments into the SPSS program, their normal distributions were examined.

Table 1 presents the normality test results for the data from the knowledge test, which is the first instrument used in the pre-test and post-test. For the data to exhibit a normal distribution, $p > .05$ is required. Since the p-value of the pre-test is greater than .05, it indicates a normal distribution. Similarly, as seen in Table 2, the data also demonstrate a normal distribution with $p > .05$.

Table 1. Kolmorogov-Smirnov test results of the Pre-test-Post-test knowledge test

	N	p
Pre-test	43	.200
Post-test	43	<.001

Table 2. Kolmorogov-Smirnov test results of the Pre-test-Post-test skills test

	N	p
Pre-test	43	.200
Post-test	43	.200

The skewness and kurtosis values of the pre- and post-test data sets of the knowledge test are shown in Table 3. As the skewness and kurtosis values of both tests are between -1 and +1, they show a normal distribution.

Table 3. Skewness and kurtosis values of the Pre-test-Post-test knowledge test data set

	Skewness	Kurtosis
Pre-test	-.502	- .064
Post-test	-.919	-.194

Table 4 shows the skewness and kurtosis values of the pre-test and post-test data sets for the skills test. The results are between -1 and +1, so it can be said that the data have a normal distribution. As a result, it was decided that parametric tests could be performed. The dependent samples t-test was used in accordance with the objectives of the study. The dependent samples t-test is used to determine whether the difference between paired means in repeated measurements on the same subjects is statistically significant.

Table 4. Skewness and kurtosis values of the Pre-test-Post-test skill test data set

	Skewness	Kurtosis
Pre-test	.664	-.328
Post-test	.450	-.654

The qualitative data obtained from the interview forms were analyzed using the content analysis method, which aims to identify concepts and relationships that provide a deeper understanding of the data. This process involves four key stages. First, the data are coded to highlight significant ideas or patterns. Next, themes are identified by grouping related codes, reflecting broader categories or concepts. Following this, the codes and themes are organized systematically to establish coherence and ensure their alignment with the research questions. Finally, the findings are described and interpreted, linking the themes to the research context and offering meaningful insights (Yıldırım & Şimşek, 2008).

Initially, each mentor and mentee was assigned a unique identifier, and the interviews were transcribed and transferred to a digital format. The data were analyzed based on the interview questions, with responses examined line by line. Codes were assigned to the data according to the questions, and the coded information was organized into tables. Relationships among the codes within the tables were then identified, leading to the determination of categories. Finally, these categories were synthesized into overarching themes to provide a structured understanding of the data.

FINDINGS

Findings with regard to the first research question, "Does TMT have a significant effect on mentors' knowledge of the mentoring process?", the results obtained by comparing the means of the knowledge test section of the pre-test and post-test with the dependent groups t-test are shown in Table 5.

Table 5. Dependent samples t-test results for pre-test and post-test knowledge scores

	N	$\overline{X}$	SS	p (2-way)
Pre-test	43	21.20	3.80	.001
Post-test	43	25.48	2.82	.001

Table 5 shows that the mean score of the pre-test on mentors' knowledge of mentoring is 21.20 and the mean score of the post-test is 25.48. As a result of the analysis, it was found that there was a statistically significant difference between the mean scores of the pre-test and the post-test knowledge test ($p<0.05$). According to this result, it can be said that the prepared and implemented TMT created a significant difference.

Regarding the second research question, "Does TMT have a significant effect on mentors' skills related to the mentoring process?", the results obtained by comparing the means of the skills test section of the Pre-test and Post-test with the dependent groups t-test are shown in Table 6.

Table 6. Dependent samples T-test results for mean scores of Pre-test and Post-test skill assessments

	N	$\overline{X}$	SS	p (2-way)
Pre-test	43	17.37	3.95	.001
Post-test	43	30.81	5.33	.001

As shown in Table 6, it can be seen that there is a statistically significant difference between the Pre-test and Post-test averages including the skill-based sample scenarios ($p<0.05$). The Pre-test mean increased from 17.37 to 30.81 in the Post-test with an increase of 13.44 points. Based on this finding, it can be said that the mentors responded to the case studies in a way that reflected the content of the training after completing the TMT. In other words, it can be said that the mentors' ability to solve possible problems they might encounter in the program increased after the TMT, which included academic communication skills, time management and self-confidence as a mentor.

As a result of the analysis of the interviews conducted with the voluntary participation of five mentors for the third research problem, "What are the opinions of the mentors participating in TMT about the training", four themes and subcategories were obtained. The themes are as follows: the mentors' opinions before TMT, the mentors' opinions after TMT about the effect of the training, the TMP process, and the mentors' opinions after TMP. All themes and categories are listed in Table 7.

Table 7. TMP themes and categories

Themes	Categories
Opinions of Mentors Before TMT	Mentors' Experiences, Preliminary Information on TMT and TMP, Mentors' Attitudes towards TMP
Opinions of Mentors on the Impact of Training after TMT	The Effect of TMT on Acquiring Mentoring Skills, Qualities of an Effective Mentor, Feeling Ready to Mentor, Scoring TMT
TMP Process	Mentors' successes in TMP, Mentors' failures in TMP, Pleasant aspects of TMP for mentors, Problematic aspects of TMP for mentors, Evaluation of the TMP process.
Mentors' Views After TMP	Me as a Mentor, What TMP Contributes to the Mentor, Desire and Reason for Becoming a Technology Mentor Again, Suggestions for TMP to be more effective, Suggestions for TMT to be more effective

As can be seen in Table 7, there are three categories under the topic of mentors' opinions before TMT. These are mentors' experiences, prior knowledge about TMT and TMP, and mentors' attitudes towards TMP.

In the category of mentors' experience, it was found that none of the mentors had any experience of mentoring or reverse mentoring before the TMP. In the category of preliminary information about TMT and TMP, it was found that almost all mentors felt that the information provided before the process was sufficient. The views of one mentor on this issue are as follows:

"I think it was sufficient. Before we started, our teacher gave us a form and we solved it. Then she asked us to watch the videos. They were quite instructive. Apart from that, some guidance documents were shared in the Moodle environment. I found it sufficient for me and I had no problems." (Mentor 4)

When analysing the results of the category of mentors' attitudes towards TMP, it was found that two mentors were excited, one mentor was reluctant and three mentors were anxious. The common characteristic of the mentors who were excited and anxious about the program was that they would be teaching someone older than themselves. Two mentors commented on this as follows:

"The program excited me at first. The main reason was that I would be training a faculty member who was older and more experienced than me". (Mentor 4)

"I did not believe in myself. The main reason was that the idea of training someone older than me in terms of age and experience stressed me out". (Mentor 5)

The categories under the topic "Mentors' opinions on the effectiveness of the training after the TMT" are as follows: The effectiveness of the TMT in acquiring mentoring skills, qualities of an effective mentor, feeling ready for mentoring, evaluation of the TMT. For the category 'The effectiveness of TMT in developing mentoring skills', one mentor answered 'somewhat effective', two mentors answered 'effective' and two mentors answered 'highly effective'. Mentor 1, who answered "somewhat effective", stated: "I was not aware of the I and you language. It helped me in this respect. Mentor 4, who found the training effective, said: "It was very good that the videos were short so we did not get bored. It was a very good strategy to divide them into topics." Finally, Mentor 2, who found the training very effective, said: "I found it very effective. It provided support on how to behave with our mentee and how to solve the problems we might encounter".

The codes related to the category "Qualities of an Effective Mentor" are shown in Table 8.

Table 8. Qualities of an effective mentor

Codes	N	%
Self-confident	1	20
Patient	1	20
Preparing in advance	2	40
Being a guide	1	20
Strong communication skills	2	40
Good time management	2	40
Knowledgeable about the subject	1	20
Acting according to the learner's level	1	20

According to Table 8, the most frequently mentioned codes are 'preparing in advance, strong communication skills and good time management'. Regarding preparing in advance, Mentor 5 said: "The mentor should be prepared. He/she should definitely do his/her preparation (study). Even if he/she knows the subject, he/she should always be prepared." Regarding the code for strong communication skills, Mentor 4 said, "He/she should have improved his/her communication skills. For example, my mentee had some visual impairments. As he told me this in the first meeting, I adapted my planning accordingly. If I had not been informed about his visual impairment, we might have had problems in the process." Regarding the code of good time management, Mentor 3 said: "You should plan your time effectively. He/she should be able to manage his/her time well both inside and outside the classroom". Other characteristics of an effective mentor are "self-confident, patient, being a guide, knowledgeable about the subject and acting according to the learners' level". For example, for the code "being a guide", Mentor 2 said: "An effective mentor should be more passive than active. The mentor should step in where the mentee gets stuck."

When analysing the results in relation to the category of feeling ready to mentor, four out of five mentors stated that they felt ready to mentor after the training they had received. For example, Mentor 1 said, "At the beginning of the program, I was afraid, but when I started to communicate, I overcame my fear. After the TMT, I felt ready to mentor", while Mentor 4, who said he was not ready, said: "Actually I did not feel ready. But it was not because the training I received was inadequate. I was excited and stressed because it was my first time as a mentor. The main reason was that I was going to teach a lesson to a faculty member who was older than me".

In the category of TMT evaluation, the results of the mentors' evaluation of the TMT out of 10 were presented. The scores ranged from 6 to 9.5. Here are some of the mentors' opinions on this evaluation;

"I would give it a 6 because I could not get a clear answer to some questions. The only thing I could learn was the I/you language title. I could not find the answers I was looking for in the videos. (Mentor 1)

"I can give it a 8.5 out of 10. I think sometimes the same things are repeated in the videos. (Mentor 2)

"I give it a 9.5. I can't think of anything to criticise." (Mentor 5)

The categories under the theme of the TMP process are as follows: Mentors' successes in the TMP, Mentors' failures in the TMP, Pleasant aspects of the TMP for mentors, Problematic aspects of the TMP for mentors and Evaluation of the TMP process.

According to the findings under the category of mentors' successes in the TMP, mentors felt successful in the areas of effective communication, explaining the topic well, and time management. Five of the mentors reported that they were successful in effective communication; two mentors reported that they were successful in time management. The mentors' views on the areas in which they felt they were successful were as follows:

"I think we explained the topic and practice well during the mentoring process. I can say that our communication with the faculty was also very successful. (Mentor 3)

"I think I use time management correctly. I think I am successful in communication skills and time management." (Mentor 4)
According to the findings on mentors' failures in the TMP, only two mentors stated that they had failed in terms of discipline and time management. For example, Mentor 1 stated, "I think I failed in terms of discipline. I think I should be more insistent on homework."

The results for the category of enjoyable aspects of the TMP for mentors are shown in Table 9.

Table 9. Enjoyable aspects of the TMP

Codes	N	%
Honest communication with the mentee	3	60
One-to-one training	4	80
Teaching a person who has reached a point in their life	2	40
Creating an effective teaching-learning environment	2	40
Liking the subject matter	2	40

According to Table 9, one-to-one training and honest communication with the mentee are the most enjoyable aspects of the mentoring process. Other pleasurable points are 'giving education to a person who has reached a certain point in his/her life, creating an effective teaching-learning environment and liking the subject being taught'. Some mentors' opinions on this subject are as follows:

"Honestly, I really enjoyed talking to the faculty member. I felt valuable. It felt very nice to give education to a person who has reached a place in his life". (Mentor 1)

"The one-to-one training made it enjoyable. Even though he was older, our mentee could talk to us like a friend, our mentee also came to the classes motivated and trusted us as mentors." (Mentor 2)

The results of the category of problematic aspects of TMP for mentors are presented in Table 10.

Table 10. Problematic aspects of TMP

Codes	N	%
Mentee's failure to perform assigned tasks	1	20
Mentee is reluctant and closed to solution	1	20
Time management	2	40
Not knowing the subject well enough	1	20
Anxiety	1	20
No problem	1	20

Table 10 shows that the most common problem is time management. Other problems experienced include 'mentee's failure to perform assigned tasks, mentee being reluctant and closed to solutions, and mentor's anxiety and lack of knowledge about the subject'. Some mentors' opinions on this subject are as follows:

"I had problems like not getting feedback and not being able to meet. The most difficult thing was setting the days and times for the meetings. I did not expect our mentee to be reluctant. I tried to overcome this, but I could not completely overcome this problem because the other party did not want to." (Mentor 1)

"The timing was problematic. Although 2 hours was enough for Canva, it was not enough for the website. Looking back now, I think I should have continued with Canva." (Mentor 5)

According to the results of the TMP Process Evaluation category, while four mentors stated that the process was effective, one mentor rated the process as unsuccessful. Mentor 3 stated: "My mentoring process was very good. One of the most effective reasons for this was the good and effective communication between my mentee and myself". Mentor 1 said: "I think the training was not successful because the tasks were not completed. Unfortunately, my observations showed me that this was the case". The categories under the last theme, Mentors' opinions after TMP, are as follows: Me as a mentor, What TMP contributed to the mentor, Want to become a technology mentor again and why, Suggestions for TMP to be more effective, Suggestions for TMT to be more effective.

Regarding the category 'I as a mentor', it was found that almost all mentors rated themselves as 'good mentors'. For example, one mentor expressed his opinion as follows;

"I think I am a good communicator. I had a good command of the subject I was teaching and I think I taught in a clear and understandable way. I have fulfilled our responsibilities in terms of time. In short, when I evaluate myself, I think I am a good mentor." (Mentor 3)

The results for the category What TMP contributes to mentoring are presented in Table 11.

Table 11. TMP's Contribution to mentoring

Codes	N	%
Being more organized	2	40
Developing teaching skills	2	40
Using time more effectively	2	40
Improving communication skills	2	40

According to Table 11, the TMP contributed to the mentors being more planned, using their time more effectively, improving their communication skills and improving their teaching skills. For example, in terms of being more planned, Mentor 1 said: "Yes, I have learnt to be more planned, I have realised the importance of this and of course I have learnt that I should tell others about these plans."" In terms of time management and communication skills, Mentor 4 said, "It has had a positive impact on my life in terms of time management and planning. I also think my communication skills have improved".

Regarding the category of willingness and reason to become a technology mentor again, four mentors stated that they would consider mentoring again because the process helped them a lot, but one mentor stated that he was undecided because of time constraints. One mentor's view on this was as follows:

"Yes, I do. Because for me the best way to learn and reinforce something is to explain it. It also makes me very happy to see that the information I give is passed on to the other person. For these reasons, I would consider being a mentor again." (Mentor 4) Findings related to the category of suggestions for making TMP more effective are shown in Table 12.

Table 12. Suggestions for making the TMP more effective

Codes	N	%
Mentees are more motivated	1	20
More descriptive and detailed interview templates	1	20
Having ready materials and lesson plans	1	20
Pre-training of mentees	2	40
Mentees do not change topics in the process	1	20

According to Table 12, pre-training of mentees is the most frequently mentioned suggestion. Mentor 5 stated: "I can suggest that mentees should be given more information before pairings are made." Other suggestions include: 'mentees should be more willing, interview templates should be more descriptive and detailed, there should be ready-made materials and lesson plans, and mentees should not change topics during the process'. For example, regarding the suggestion that mentees should be more willing, one mentor said the following:

"I think the mentee should be as willing as the mentors. That is a very important detail. If the mentee just comes to class or does not fulfil his/her responsibilities, if he/she is not willing, the process will be very inefficient. I think the mentees should choose their courses with this in mind." (Mentor 3)

The results for the category "Suggestions for making TMT more effective" are presented in Table 13.

Table 13. Recommendations for making TMT more effective

Codes	N	%
Separate videos for each scenario	1	20
Adding animations and visual materials	4	80
Preventing repetitions	1	20
No suggestion	1	20

According to Table 13, almost all mentors suggested that TME should be enriched with animations and visual materials. In this regard, Mentor 1 stated: "It should be diversified with animations and visualisations". Mentor 4 stated: "Animations and visual materials can be added to the training videos."

Other suggestions included "having a separate video for each scenario and avoiding repetition of the topic". Mentor 1 said: "I think there should be more videos and even separate videos for each scenario. I would like the scenarios to be enriched and to have concrete results and suggestions for each scenarios".

As a result of the analysis of the interviews conducted voluntarily with the participation of three mentees for the fourth research problem, "What are the opinions of the mentees participating in the TMP about the technology mentors and the program", one theme and four categories were obtained Table 14.

Table 14. Themes and categories of mentee opinions

Theme	Categories
TMP Process	Enjoyable Aspects of TMP for Mentees, Problematic Aspects of TMP for Mentees, Successful Aspects of TMP for Mentees, Unsuccessful Aspects of TMP for Mentees

According to Table 14, the categories of mentees' experiences in the TMP process are as follows: Mentees' enjoyable aspects of the TMP, mentees' problematic aspects of the TMP, mentees' successful aspects of the TMP and mentees' unsuccessful aspects of the TMP.

The results for the category 'Enjoyable aspects of the TMP for mentees' are shown in Table 15.

Table 15. Enjoyable Aspects of the Technology Mentoring Process for Mentees

Codes	N	%
Working with an experienced and enthusiastic students	2	66.66
Mentor is systematic and planned	2	66.66
Communicating with students from different departments	1	33.33
A process that is personalized and tailored to my needs	2	66.66

According to Table 15, mentees indicated that the most enjoyable aspects were working with an experienced and enthusiastic student, the systematic and planned nature of the mentor, and the fact that the process was tailored to their specific needs. One mentee stated that it was enjoyable to communicate with students from different departments. The mentees' views on this were as follows:

"It was enjoyable to work with an experienced and enthusiastic student. It was also an exciting experience for someone younger than me to teach in a systematic way." (Mentee 1)

"My mentor was a very good mentor. He made it easier for me to learn thanks to his effective presentation. His guidance was also very good." (Mentee 3)

"I liked the fact that it was a process tailored to me and my needs. I was happy that we were able to meet on the days and times we agreed." (Mentee 2)

When analysing the findings related to the category of problematic aspects of the TMP from the mentees' perspective, problems such as the postponement of the lessons, the 5-week duration of the process, and the lack of a structured plan were mentioned. The mentees expressed the following opinions on this issue:

"When the postponement of the lesson was discussed, I felt uncomfortable about why we were postponing it. But I think these things I said are things that make people better. " (Mentee 3)

"As someone who cares about structuring, it would have been better if a list was prepared as "what we can learn on Canva" and we could have progressed by making choices from that list." (Mentee 1)

According to the findings in relation to the category of topics where mentees were successful in the TMP, mentees stated that they were successful in learning technology quickly and in communication. One mentee's opinion on this topic is as follows:
"I learn quickly, and I am good with technology. I can easily understand and develop a program even if it is in English. When my friends gave me a presentation assignment, I think I had a good time as a student making a poster. I think I am a positive mentee in terms of communication. "(Mentee 3)

In terms of the category of issues where mentees felt they had failed in the TMP, two mentees stated that they had failed in time planning, while one mentee stated that he did not think he had failed. Mentee 3's opinion on this issue is as follows:
"Sometimes I could not finish my presentations. More specifically, I could not finish them in time. The reason was that I did not have enough time due to children at home and work at school. Therefore, I can criticise myself for not completing my assignments on time."

CONCLUSION AND DISCUSSION

The aim of this study was to investigate the effectiveness of technology mentoring training for undergraduate students who participated as mentors in the Technology Mentoring Program at a state university, and to identify the participants' views of the training.

The study found that the post-test knowledge scores of the mentor students were statistically significantly higher than the pre-test scores. This suggests that the TMT increased the students' knowledge about mentoring. This result is also supported by the findings in the themes of mentors' opinions before the TMT and mentors' opinions after the TMT. Mentors stated that they had no experience in mentoring before the training, but after the training they felt ready to be a mentor, they had an effective process after the program and they became good mentors themselves.

Similarly, the post-test scores on the skills-based post-test, which included sample scenarios covering problems or situations that mentor students might encounter in the mentoring program, were statistically significantly higher than the pre-test scores, suggesting that the students' mentoring skills had improved. This conclusion is supported by the qualitative findings from the analysis of the mentors' opinions. Mentors stated that the design and content of the training contributed to their mentoring skills. Another conclusion that the training was effective is the mentors' views on the characteristics of an effective mentor. According to the mentors, an effective mentor is someone who has self-confidence, is patient, prepares in advance, is a guide, has good communication skills, manages time well and effectively, has good knowledge of the subject and acts according to the learners' level. It is very important that these views reflect the qualities of effective mentors emphasised in the TMT.

In addition, mentors reported that they had begun to plan more, to recognise the benefits of the mentoring experience to the teaching profession, to use time more effectively, and to improve their communication skills. Similarly, most mentors reported that they were successful in communicating effectively, explaining the lesson, and managing time. These skills overlap with the training topics included in the TMT content. In addition, it can be said that the mentor students became aware of the qualities they needed to develop in order to be effective mentors, and in this sense the TMT was supportive. Furthermore, the mentees emphasised that the mentor students were planned and systematic, used communication skills effectively, had a good command of the subject area, were confident and demonstrated effective mentoring skills.

Research across various disciplines consistently emphasizes the importance of structured mentor training programs in equipping mentors with the knowledge and skills required to excel in their roles. Studies show that such training not only helps mentors better understand their responsibilities, but also increases their awareness of the complexities of mentoring. These programs support professional development by fostering key skills and competencies such as communication, problem-solving, and guidance (Chaudhuri et al., 2022; Clutterbuck, 2004; Evertson & Smithey, 2000; Garvey & Alred, 2000; Janas, 1996; Klasen & Clutterbuck, 2002; Koksal Topcu, 2025; Kupersmidt et al., 2017; Nagy & Dringó-Horváth, 2024; Ulvik & Sunde, 2013). The findings of this study confirm these conclusions, demonstrating that the Technology Mentoring Training (TMT) program significantly contributed to the development of these critical skills among undergraduate mentors.
The TMT program, implemented as part of the Technology Mentoring Program (TMP), was highly effective in enhancing both the knowledge and practical skills of mentors. Participating mentors reported significant improvements in their confidence and readiness to mentor, while mentees expressed satisfaction with both the process and the mentors' performance. This feedback

highlights the reciprocal benefits of the program and its role in fostering a collaborative and supportive mentoring environment (Chaudhuri et al., 2022; Frey, 2021; Pollard & Kumar, 2021). Moreover, the skills gained through TMT—such as effective communication, time management, and adaptability—are not only essential for mentoring, but also valuable as life skills (Ard & Beasley, 2022). These transferable skills provide mentors with significant advantages in both personal and professional contexts, particularly for those planning to become teachers, as they can apply these competencies directly in their classrooms.

The success of the TMT program also underscores the critical role of online training in developing mentoring competencies. By offering a structured and accessible platform for mentors to acquire and refine their skills, TMT effectively supported the TMP process. The integration of technology into the training process ensures scalability and flexibility, enabling broader participation and consistent outcomes (Tondeur et al., 2023; Zhao et al., 2021). This model serves as a valuable framework for other mentorship programs, highlighting the importance of well-designed training initiatives to unlock the potential of mentors and create lasting positive impacts in both educational and professional domains (Pollard & Kumar, 2021; Toreid et al., 2025).

The effectiveness of the TMT program was evaluated using a one-group pretest-posttest design. While this approach provides valuable insights, more robust experimental designs, such as incorporating a control group, could offer clearer evidence of the training's impact on mentoring knowledge and skills. Additionally, conducting longitudinal studies could help determine how effectively mentors retain and apply the skills they acquired during the TMT program in their professional or educational contexts over time. Improvements to the training program could also be made based on participant feedback to further enrich the TMT experience. Suggestions include increasing the number of instructional videos, incorporating animations and visuals, preparing sample lesson plans and templates, revising the content for clarity, and minimizing repetitive elements. These enhancements would likely make the training more engaging and practical for participants, thereby improving its overall effectiveness.

Ethical Approval and Participant Consent: The necessary ethical approval for the study was obtained from Hacettepe University Research Ethics Committee, (Date: 10.08.2022, Ethical Clearance No: E-35853172-900-00002328988).

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