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Effect of Using Hyflex Technology Learning on Preservice Teachers' Success and Attitudes

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Abstract

HyFlex technology-based learning refers to learning that integrates face-to-face (synchronous) and online (asynchronous) learning experiences. In this study, the effects of 'Hyflex Technology-Based Learning' applications on pre-service teachers' achievement, professional attitudes and retention of what is learned compared to traditional teaching were examined. In the study, one of the true experimental design types, pre-test-post-test control group randomized design was used. The application group of the study consisted of a total of 64 pre-service teachers studying in 2 3rd grade classes at the faculty of education of a university in Almaty in the 2022 academic year. In the study, Hyflex technology-based learning in the experimental group and traditional teaching approach in the control group were applied as experimental procedures. The applications in both groups were carried out in 6 sessions and 12 hours in total. Formation course achievement test (Teaching Principles and Methods Course) and attitude towards teaching profession scale were used to collect research data. According to the findings of the study, Hyflex technology-based learning approach was found to be significantly effective in pre-service teachers' professional academic achievement and attitudes compared to traditional teaching.

Introduction

In the 21st century technology age, human beings need education more than ever. Undoubtedly, this need increases the duties and responsibilities of the teacher in the education system. Education in the digital age emphasizes globalization and internationalization. Today, in the learning atmosphere of education, developing technology and the radical transformations that occur in all areas of life accordingly affect all elements of education (Summak, 2022; Zeichner, & Liston, 1996). With these conditions that significantly change the structure and functioning of education, it is essential to take measures to facilitate the adaptation of students from all socioeconomic levels to changing conditions. Otherwise, it will be difficult to ensure equality of opportunity in education (Marquart, et al, 2018; Murat & Cam, 2022).

It is accepted by everyone that the qualifications of teachers are important in achieving the goals of education. Changes in many areas from the planning to the implementation of education have brought along discussions about the skills that teachers should possess. The current process makes it necessary to focus attention on some focal points within the framework of the new position of the teacher, the difficulties he/she faces and the opportunities he/she has. In the 21st century, teachers face a number of challenges (Ozturk, 2023; Raes et al., 2019; Tanguay & Many, 2022). When these challenges, which we can call a series of "innovations", are well analyzed, situations that can be advantageous for the teacher will emerge. Changes in fundamental issues such as learning environment, students, teaching techniques, social life and work life are critical for teachers. Teachers have a critical role to play in ensuring that students adapt to changing social structures and are prepared for the work life of the future. In order for teachers to fulfill this important task in future education, there are some basic skills such as leadership, collaboration and professional ethics (Chehimi & Alameddine, 2022; Miller, et. al, 2013).

It is obvious that an education system based on "possessing knowledge" and "transferring knowledge" will be insufficient to create the modern human model needed. A new model of education is needed to raise contemporary people (Bates & Poole, 2003; Tanguay & Many, 2022). The main objective of contemporary education is to educate students who have developed problem solving skills, who recognize the methods of accessing information, who have gained analytical thinking skills, who keep their willingness to be informed alive, to direct students to teamwork and to ensure that students are active throughout the entire learning process. The realization of this goal necessitates a change in the pre-professional and in-service training of teachers to meet these requirements (Alshammari, 2022; Leijon & Lundgren, 2019).

Education is not a process of "telling" and "being told", but an active process of "giving meaning". "Giving meaning" to classroom experiences is something that experienced teachers do every moment. Utilizing these experiences is an enriching element in preparing prospective teachers for the reality they will encounter in the classroom in the future Wasserman, (1993). Teaching through case method teaching, which is based on the development of professional competencies of teachers by utilizing each other's experiences through real life events, is developing as an increasingly important method in teacher education. This method has been found to improve individuals' ability to communicate their thoughts more effectively, to think critically, to make better decisions and to generate alternative solutions to complex problems (Ghosh, Jansz & Ghosh, 2021; Wassermann, 1994; Nagima et al., 2022; Zhumash et al., 2021; Ospankulov et al., 2022; Zhussupbayev et al., 2023).

Raising the human model required by the age and making individuals compatible with the social reality they live in is closely related to teacher education. Therefore, the objectives and content of teacher education in the modern era should be elaborated in detail. Instead of evaluating the different stages of a teacher's professional life independently and separately from each other, a more holistic definition of professional development that includes the entire professional life should be established. Some of the approaches that should be emphasized to create a rich learning environment for teachers throughout their professional lives are discussed below (Bell & Cain, 2014; Kibici & Sarıkaya, 2021).

The 21st century teacher has lost his/her central position in education, unlike in previous times, in terms of access to information. Apart from the advantages and disadvantages of this, if we first look at the reasons, it will be seen that digital transformation-based changes are the main factor. The changes in the social structure after the new technology have significantly affected education as well as all institutions of the society. Schools, programs, students, teachers, administrators and families involved in the educational process have been deeply affected by this process (Errington, 2004; Özkan, 2022). Digital transformation has also significantly changed and improved learning environments and resources. Therefore, the integration policy to be followed by schools will be important in the process of adapting technical facilities to education. Teacher leadership is important in providing students with the basic skills necessary for the use of technology. The process of integrating technology into education, which is advantageous for the development of students' individual learning speeds, is expected to give teachers more time for both their own learning and their students' learning. Since it is known that families have low access to and ability to use technology, teachers have more responsibility (Kaleli, 2021; Malczyk, 2019).

In the preparation of prospective teachers for the profession, the knowledge, skills and experiences of experienced teachers during their practice in the field are as valuable as theoretical knowledge. Such an approach to transferring what is experienced in practice to the field of education as a resource is also important for teachers' professional identities (Baş, Kubiatko & Sünbül, 2016; Doğru, 2020; Smylie, 1991). It is thought that this approach, which considers experience-based competence important, will lead teachers to take ownership of their professional experiences and competencies by participating more actively in various decision-making processes related to teaching. Teachers should both set an example for themselves and raise awareness among their students about safe and beneficial internet use. In addition to the contribution of the Internet in the education and training process, it may also have disadvantages. When it is not used correctly and efficiently, it poses risks in terms of time management. It is important to be careful about the way of using technology and the time allocated to it (Bower, et al., 2014). New teacher skills for future education are as follows (Chehimi & Alameddine, 2022; Miller, et al., 2013; Raes et al., 2019; Sünbül, 2011; Tanguay & Many, 2022):

- The teacher should be a good learner in terms of facilitating students' learning and encouraging their creativity.
- The teacher should be a talent manager who creates opportunities for students to use and develop their talents appropriately.
- The teacher should develop a strong collaborative network in order to create an effective and efficient educational environment.
- The teacher should be a role model for the positive attitudes he/she wishes for his/her students.
- The teacher should aim to provide students with the ability to learn any skill quickly and effectively rather than imparting specific professional knowledge.
- Teachers should be aware of new learning environments and be sensitive to students' requests for change when preparing for their lessons.
- Teachers should both set an example for themselves and raise awareness among their students about safe and useful internet use.
- Teachers should develop themselves in technology literacy in order to use information technology actively in educational activities and in foreign language learning in order to follow the developments in their

field from international literature as well as national literature.

New Learning Environments

New technologies, especially artificial intelligence technology, have had a significant impact on all processes of knowledge. This process, which has built a new learning atmosphere, has been the beginning of a completely different era, from learning spaces to the position of the instructor. The learning environment, which represents a specific place in the educational literature, has started to gain a new dimension in our century. This new learning environment, which points to an unlimited world guided by keys and links, is turning into a shaking discussion environment in very fundamental areas such as the nature, meaning, reflection, source and truth dimension of knowledge (Bower et al., 2014). In this new formation, the current definition of school remains limited and restrictive. Because in the near future, there is a strong possibility that the "new school" will move into a virtual space and become as complex, diverse and classless an institution as possible. Distance education and online classrooms will bring a new dimension to both the school and the classroom. New learning environments are just beginning to develop and give clues that the entire education system will and should change. Therefore, it is inevitable that teachers, one of the main actors of education, will be affected by this change (Ortiz, Green, & Lim, 2011; Sünbül, Gündüz & Yılmaz, 2002).

New Students

Social and cultural changes take place over long periods of time. When these changes take place, teachers and students, who are already members of society, also change. Therefore, the relationship between social changes and education is slightly different from other fields (Alpaydın, 2018). Teachers, as both the object and the subject of change, are more affected by this process. One of the areas that force teachers to change is the change in students' learning habits (Beringer, 2009; Bounds, 2010). Parallel to the social life of the student, there are significant changes in the learning process. In particular, new technologies affect the world of young people more than adults. Young people, who are the natives of the online world, and adults, who are the refugees of the online world, have a problem of adaptation in a sense. For young people, the new world is a space with a variety of learning tools, without borders, where everything is connected to a button. As members of the online world, they can easily access people from all cultures and all kinds of inFformation. With unlimited sources of information at their fingertips, students can access many sources that address an issue they want to learn about from different perspectives. This process, which will increase students' sense of curiosity, diversify and facilitate their learning, has both advantages and disadvantages (Aggarwal, 2000; Bhakta & Dutta, 2016). Instant messaging can negatively affect students' concentration. Being constantly in the online world causes young people to perceive real life as - literally - "offline". Online engagement can also cause problems of adaptation to the real world. Moreover, when young people spend too much time in this virtual world, it can negatively affect both their academic success and their health. While parents expect that the effective use of new technology will increase their children's academic achievement and predisposition to future job opportunities (Ortiz, Green, & Lim, 2011), young people use technology for entertainment rather than school responsibilities (Becker, 2000). On the other hand, the fact that technology is expensive to monitor may trigger inequality in education.

The effect of the use of technology on the student's imagination and learning skills are among the issues that have been studied. In particular, some studies have been conducted that handwriting is more effective on the development and productivity of the human brain than keyboarding (Beringer, 2009; Bounds, 2010). The use of technology has disadvantages such as students' reluctance to study because everything is at their fingertips, the information they access may not always be useful information, and they may spend more time on social media accounts while doing research, which may lead to low academic performance. On the other hand, research has shown that it has advantages such as encouraging independent learning, making learning fun, enabling students to plan their own lives as it provides access to education without going to school, preparing students for the future, facilitating and encouraging collaborative learning, and not wasting time to access information (Aggarwal, 2000; Bhakta & Dutta, 2016). Considering the advantages and disadvantages, it will be an important goal for teachers to achieve a balance in students' use of technology (Beatty, 2012).

Digital transformation has significantly changed and improved learning environments and resources. Therefore, the integration policy to be followed by schools will be important in the process of adapting technical opportunities to education (Arabacıoğlu, 2022; Chiraz, 2022; Ndibalema, 2021; Shen, 2021; Yolcu, 2015). Changing social life and educational environment significantly affect the determination of teacher skills. In addition to pedagogical expectations, the intense impact of technology on the learning environment has made it important for educators to closely follow technology and related changes. Teacher leadership is important in providing students with the basic skills necessary for the use of technology (Beringer, 2009; Bounds, 2010).

COVID-19 has led to the introduction of many life-limiting measures around the world. Depending on the number of cases, measures have been further increased or decreased. These measures have led to radical changes in the public and private sectors. In terms of education, in order for higher education to continue, most countries have rapidly created the necessary infrastructures to utilize digital opportunities (Ozkan, 2022; Throckmorton, 2008). Universities operating with the formal education method have rapidly switched to distance education. Considering that this method was put into practice compulsorily in a crisis and is a temporary solution, it is more accurate to call it the emergency distance education method. Because there are fundamental differences in theoretical and practical dimensions between the distance education system and emergency distance education during the pandemic. For this reason, it is very important to consider this situation in the evaluation of the findings obtained within the scope of the study in order to prevent potential misconceptions (Sangster et al., 2020).

HyFlex Learning

With hybrid models, it is seen that the education model in which students can receive both face-to-face and online education is applied in many countries. In addition to the technologies used to enrich the traditional education model with online education materials, it can be thought that the learning speed and quality are increased by supporting traditional education models with the use of traditional learning methods of different educational philosophies. In the literature, it has been seen that hybrid education and learning, also known as blended learning, has advantages such as flexibility in the educational environment, increase in learning level, permanence, increased interest in learning, quality interaction, and economy (Abass, Arowolo & Igwe, 2021; Haubrich &

Hafermalz, 2022; Yapıcı & Akbayın, 2013). According to Soydan (2008), hybrid (blended) distance education environments and online learning environments contribute positively to student success. It was seen that the interviewed administrators defined Hybrid education by drawing attention to the positive aspects of distance and online education as stated in this research. It was seen that hybrid learning provides a permanent teaching and increases academic achievement in students compared to face-to-face education. They stated that hybrid learning would be more effective and efficient compared to face-to-face learning. The interviewed administrators stated that in the hybrid learning model, teacher and student interaction is more and planned work is obligatory (Armstrong, 2022; Delialioglu & Yildirim, 2007; Flynn-Wilson & Reynolds, 2021).

Today's young adults are trying to juggle multiple life roles. Multiple life roles, such as student, employee, young manager or job seeker, impose various constraints on lifelong learning. Young adults need flexibility in time and learning. HyFlex is an attractive option to expand learning opportunities for young people who are enrolled in face-to-face courses, but who also have to fulfill other responsibilities (Miller, & Baham, 2018). HyFlex is a combination of the words "hybrid" and "flexibility". This is because HyFlex learning blends online and face-to-face education (hybrid / blended learning) components into a single course and offers students flexibility in when and how they participate. HyFlex is similar in structure to blended learning, but differs from it in the opportunities it offers for participation. In this context, HyFlex learning is defined as the blending of online and face-to-face educational components into a single course and offering learners the flexibility to choose when or how to participate (Beatty, 2012; Keiper et al., 2021; Raman et al., 2021).

HyFlex Course Design Model, HyFlex, which allows for a flexible structure that adapts to changing conditions, refers to a dynamic process that can be switched between models and scenarios (face-to-face, distance, hybrid) and is a combination of the words hybrid (Hybrid) and flexible (Flexible). In HyFlex, technology is a natural part of the educational process; this approach provides students with flexibility and seamless engagement and follow-up regardless of where, how or when they attend class (Gault & Cuevas, 2022; Lim, 2004). HyFlex course design provides a solution by combining internet video training like Zoom, regular online learning, and face-to-face classroom experiences into a single course where students can choose the method that best meets their individual learning needs and even switch between methods throughout the course session. HyFlex aligns with student-centered education and provides educators with a unique opportunity to deliver quality undergraduate courses. Blending both online and face-to-face components in a single course, Beatty (2006) and Liu & Rodriguez (2019) states that it gives students the option of attending classes online, face-to-face, or both. Accordingly, the four basic principles of HyFlex are as follows:

1-*Student Choice:* The primary reason for using HyFlex is to give students a choice in how they complete course activities.

2-*Equivalence:* To provide students with equivalent learning activities across all participation pathways.

3-*Reusability:* In each engagement pathway, to use the data from the learning activities to enhance the students' learning experience.

4-*Accessibility:* Equipping students with technology and enabling them to participate in all ways.

HyFlex's flexibility helps students in a variety of ways. In addition to providing a balance between students'

personal and professional lives and their learning responsibilities, it has many educational advantages. First and perhaps most importantly, it allows students to customize their educational experience. Students with various levels of experience and expertise in the subject matter will participate in the course. It is inevitable that some of them will need more or less guidance and direction than others (Wofford, 2011). HyFlex learning allows them to choose the type of learning that is best for them. Some learners learn better online, while others learn better face-to-face. Students choose a more rational way according to their needs and learning style. Education experts have found that flexible models that give students more control over their learning experience help them take the initiative in learning, which in turn reinforces their metacognitive skills. In similar studies on hybrid learning models, it is seen that hybrid models and increases in student engagement and student achievement are directly related to each other (Writers, 2013). In the study examining the effect of 'Hyflex Technology-Based Learning' applications on pre-service teachers' achievement, professional attitude and retention of what is learned compared to traditional teaching, answers to the following questions were sought:

- To what extent do 'Hyflex Technology Based Learning' practices affect pre-service teachers' professional attitudes compared to traditional teaching?
- To what extent do 'Hyflex Technology Based Learning' practices affect the retention of pre-service teachers' learning compared to traditional teaching?

Method

In the study, a randomized design with pretest-posttest control group, which is one of the true experimental design types, was used. In experimental models, it is aimed to examine the determination of cause-effect relationships and this model is a research model in which the data to be observed are produced under the direct control of the researcher. In the one-group pre-test post-test model, which is one of the experimental models, the effect of the independent variable on a randomly selected group is tested.

There are both pre- and post-experiment measurements (Leavy, 2017). The main thing here is the effect of the independent variable on the subjects between pre-experiment and post-experiment. In the Pre-Test Post-Test control group randomized design model, there are two groups assigned by random sampling. One of them is the experimental group and the other is the control group. In the education process in both groups, measurements are made both before and after the experiment. This method is among the most widely used models in the field of educational sciences, especially in social sciences. In such studies, the pre-test scores of the two groups should be as close to each other as possible (Kaptan, 1998).

In this model, conducting pre-tests helps to know the degree of similarity of the groups before the experiment and to organize the post-test results accordingly. In this model, pre-test and post-test measurement results are used together to decide to what extent the independent variable is effective (Fraenkel et al., 2012). In this context, in this study, the effect of 'Hyflex Technology-Based Learning' applications on pre-service teachers' achievement, professional attitudes and retention of what is learned compared to traditional teaching was examined. The explanatory view of the experimental design applied in this research is given in Table 1.

Table 1. Pre-Test Post-Test Control Group Randomized Design Used in the Study

	Pre-test	Experimental Procedures	Post-test	Retention Test
Control group	O1	C	O2	O3
Experimental group	O1	X	O2	O3

O1- Pre-tests

O2- Post-tests

C- Procedure in the Control Group (Traditional teaching)

X- Experimental procedure performed in the experimental group (Hyflex Technology Based Learning application).

O3- Retention test

The application group of the research consists of 2 3rd grade classes in the faculty of education of a university in Almaty in the 2022 academic year. The homogeneity of these two groups was ensured by pretests. Then, one was randomly assigned as the experimental group and the other as the control group. There were 17 girls and 15 boys in the control group and 16 girls and 16 boys in the experimental group, totaling 44 pre-service teachers in the research group. In the study, it was observed that the pre-service teachers in the control group, where traditional teaching was carried out, and the students in the experimental group, where 'Hyflex Technology-Based Learning' applications were carried out, had an equal achievement distribution before the research.

Experimental Procedure

The following experimental procedures were carried out in this study in which the effect of Hyflex technology-based Learning applications on pre-service teachers' achievement, professional attitudes and retention of what was learned.

-Teaching principles and methods achievement test and attitude towards teaching profession scale were applied to both groups as pretest. The application was carried out simultaneously on the same day.

- 'Hyflex Technology Based Learning' plan and program were developed for pre-service teachers to be applied in the experimental group. For this purpose, 'Hyflex Technology-Based Learning' application that contributes to the realization of the achievements of the course in accordance with the curriculum of the teacher training program teaching principles and methods course was developed. In this context, a plan that exemplifies the content related to 2 learning outcomes from the 'Teaching Strategies' learning area and 3 learning outcomes from the 'Teaching Methods and Techniques' learning area and transforms them into activities was prepared. Then, a 'Hyflex Technology-Based Learning' program that represents and exemplifies the relevant learning areas and outcomes, is suitable for the fields of pre-service teachers, attracts their attention and motivates them to the activities was prepared. At this stage, the opinions of 1 academician with a doctorate in educational sciences, 1 instructional technologist, 1 computer program software developer and 1 expert in the field of curriculum and instruction were consulted. In the experimental group where 'Hyflex Technology-Based Learning' was implemented, a mixed blended learning application was carried out in which the instructor, face-to-face students and remote students interacted with video, audio and chat technologies. The application took place for 12 hours within the framework of the instructional program's directive.

Before the 'Hyflex Technology-Based Learning' implementation, warm-up activities were carried out for both the instructor and the participant pre-service teachers about the ways of creating and sustaining community. For the 'Hyflex Technology-Based Learning' implementation, the instructor and pre-service teachers created lesson session plans together. In this plan, each class session was planned taking into account the learning objectives of the course, the diversity of the participants and the classroom organization. For the 'Hyflex Technology-Based Learning' application, the Moodle program was installed on the classroom computers and student computers. Within the scope of the 'Hyflex Technology Based Learning' application, task sharing of face-to-face and distance students, guidance, instructions, learning activities were planned and implemented in detail.

- In the experimental group, mixed blended teaching practices involving face-to-face and distance learners were implemented. For the live classroom sessions, face-to-face and distance learners were actively engaged. Communities were created with activities that attracted the interest of all pre-service teachers in the experimental group and connected face-to-face and distance participants. In the experimental group, alternating roles were assigned between face-to-face and distance learning participants. Students who were in the face-to-face education group in the classroom in one session assumed roles in the distance education group in the next session. Likewise, participants in the distance education group took part in the face-to-face interaction group in the next session. In all sessions in the experimental group, discussions and peer interactions took place between the face-to-face and distance education groups. Each face-to-face student had a device with a camera connected to a distant friend and was responsible for positioning the camera, consulting with the friend and ensuring that the friend could contribute to the discussion. At this stage, the course instructor devoted her attention to both the face-to-face and remote synchronized students. At the end of each session in the experimental group, the participating pre-service teachers received live questionnaires, self-assessment forms and topic assessment tests.

At this stage, the control group received the traditional teaching approach based on the principles of the existing curriculum.

- After the end of the experimental procedures, teaching principles and methods achievement test and attitude towards teaching profession scale were applied to both groups as pre-test. The application was carried out simultaneously on the same day.

-After the post-test applications, no action was taken in both groups for 15 days. Finally, the teaching principles and methods achievement test was applied to both groups as a retention test. The application was carried out simultaneously on the same day.

Data Collection Tools

Formation Course Achievement Test

The achievement test produced to measure the academic achievement of pre-service teachers in the subjects in the "Formation Course" was applied to both groups as pre, post and retention tests. The achievement test consists of 40 multiple-choice test questions. The version of the achievement test used in the application in the experimental process can be scored in the range of 0-40 and all questions in this test have the same score return. In the process of creating the achievement test, the acquisitions in the "Teaching Principles and Methods" subject

of the formation curriculum were taken into consideration. Consisting of 40 different multiple-choice questions, the academic achievement test was applied to prospective teachers at the same level in the experimental and control groups of the study as a pilot application. The data obtained through the pilot application were analyzed in SPSS 26.0 package program. As a result of these applications, values related to reliability, validity and item difficulties were obtained. The discrimination indices of the items of the test ranged between .34 and .81. These data show that each item of the achievement test developed for pre-service teachers has a high level of discrimination. For the reliability of the test, each correct answer was coded as 1 and each incorrect and blank answer was coded as 0. When the 40-question achievement test was analyzed for reliability, the KR-20 value was found to be .86.

Attitude Scale towards Teaching Profession

It was developed by Üstüner (2006) to measure the attitudes of students studying in teaching programs towards the teaching profession. In its original form, the scale is a Likert-type attitude scale consisting of 34 items and one dimension. Opposite each of the attitude statements, there are options ranked from 5 to 1. For each statement, "three points" represented moderate level of agreement, "one point" represented the degree of attitude at the negative end, and "five points" represented the degree of attitude at the positive end. The options opposite the items and their point equivalents were organized as 5= Completely Agree, 4= Mostly Agree, 3= Moderately Agree, 2= Partially Agree and 1= Strongly Disagree. Negative statements were scored in reverse order. According to the results of the reliability analysis, the Cronbach Alpha reliability coefficient of the scale is .93. In the reliability analysis conducted by the researchers, the Cronbach Alpha reliability coefficient of the scale was calculated as .95. The reliability coefficient of the scale was calculated to be .89 by analyzing the participants of this study. This calculated reliability coefficient explains the consistency of the items in the data collection tool with each other and to what extent they reflect the problem in this data collection tool. In order to interpret the level of reliability of the items in this data collection tool, the ranges specified by Charter (1995) are examined. These ranges are given below. - If $0.00 \leq \alpha < 0.40$, the scale is not reliable. - $0,40 \leq \alpha < 0,60$ means that the scale has low reliability, - $0,60 \leq \alpha < 0,80$ means that the scale is reliable, - $0,80 \leq \alpha < 1,00$ means that the scale is highly reliable. According to these values, a reliability coefficient of 0.70 and higher is sufficient for the reliability of the test scores. The reliability coefficients obtained in the study show that the data collection tool is reliable.

Data Analysis

The quantitative data in the study were transferred to the Statistical Package Program SPSS 26.0. Statistical techniques such as mean, standard deviation, independent sample t-test were used to analyze the transferred quantitative data. Where and for what purpose the techniques were used are explained in the findings and interpretations section. The Shapiro-Wilk test was used to examine whether the test data were suitable for normal distribution, which is one of the most important conditions for analyzing the test data with parametric tests (Kwak & Kim, 2017). Since the data obtained from pre-service teachers met the assumptions of normal distribution, parametric statistical techniques were used in the study.

Findings

Independent t-test technique was used to compare the pre-test formation course achievement scores of the experimental and control group pre-service teachers. As can be clearly understood from Table 2, the mean of the pre-service teachers in the control group was 9.69 and the standard deviation was 2.22. The mean pre-test achievement score of the participants in the experimental group was 9.44 and the standard deviation was 1.29. As a result of the analysis performed to reveal the significance of the difference between the groups, the t value was calculated as 0.55. This result did not reveal a significant difference at 0.05 significance level. In other words, it can be said that the pre-service teachers in the experimental and control groups were equivalent to each other in terms of academic achievement in the formation course.

Table 2. Comparison of Pre-test Formation Course Achievement Scores of Experimental and Control Group Pre-service Teachers

	Group	N	Mean	Std. Deviation	t	p
PreTest	Control	32	9.69	2.22	0.55	0.58
	Experimental	32	9.44	1.29		

When Table 3 related to the post-test achievement results is examined, the average of the pre-service teachers in the control group was 16.78 and the standard deviation was 2.21. The mean post-test achievement of the pre-service teachers in the experimental group was 21.97 and the standard deviation was 4.00. The t-value to reveal the significance of the difference between the groups was calculated as 6.48. This result obtained expresses a significant difference at 0.05 significance level. When the averages of the groups were examined, it was seen that the post-test achievement average of the pre-service teachers in the experimental group was higher than the average of their peers in the control group. In other words, it can be said that the experimental method (Hyflex Technology-Based Learning) was effective in the success of pre-service teachers in teaching formation courses.

Table 3. Comparison of Post-test Formation Course Achievement Scores of Experimental and Control Group Pre-service Teachers

	Group	N	Mean	Std. Deviation	t	p
PostTest	Control	32	16.78	2.12	-6.48	0.00
	Experimental	32	21.97	4.00		

When we look at Table 4 about the retention results of the information learned in the teaching formation, the average of the pre-service teachers in the control group was 14.56 and the standard deviation was 2.63. The mean of the retention test of the pre-service teachers in the experimental group was calculated as 19.50 and the standard deviation as 3.85. The t-value to reveal the significance of the difference between the groups was calculated as 5.99.

This result indicates a significant difference at 0.05 significance level. When the mean retention test scores of the groups were examined, it was seen that the mean retention scores of the pre-service teachers in the experimental

group were higher than the mean of their peers in the control group. According to this result, it can be said that the experimental method (Hyflex Technology-Based Learning) was effective in the learning retention of pre-service teachers in teacher formation courses.

Table 4. Comparison of the Retention Test Scores of the Experimental and Control Group Teacher Candidates

	Group	N	Mean	Std. Deviation	t	p
RetantionTest	Control	32	14.56	2.63	-5.99	0.00
	Experimental	32	19.50	3.85		

As seen in Table 5, the independent t-test technique was used to compare the pre-test attitude towards teaching profession scores of the experimental and control group pre-service teachers. As can be clearly understood from the table above, the mean attitude score of the pre-service teachers in the control group was 3.33 and the standard deviation was 0.26. The mean pretest attitude score of the participants in the experimental group was 3.40 and the standard deviation was 0.41. In order to reveal the significance of the difference between the groups, the t value was calculated as 0.73. This result did not cause a significant difference at 0.05 significance level. In other words, it can be said that the pre-service teachers in the experimental and control groups were equivalent to each other in terms of their attitudes towards teaching profession before the research.

Table 5. Comparison of Pre-test Attitude towards Teaching Profession Scores of Experimental and control Group Pre-service Teachers

	Group	N	Mean	Std. Deviation	t	p
Pre-Attitude	Control	32	3.33	0.26	-0.73	0.47
	Experimental	32	3.40	0.41		

When the results of the post-test attitude towards teaching profession scale were analyzed, the mean of the pre-service teachers in the control group was 3.33 and the standard deviation was 0.28 (see Table 6). The post-test attitude mean of the pre-service teachers in the experimental group was 3.51 and the standard deviation was 0.42. The t-value to reveal the significance of the difference between the groups was calculated as 2.04. This result obtained expresses a significant difference between the groups in terms of attitudes towards teaching profession at 0.05 significance level. When the averages of the groups were examined, it was found that the post-test attitudes towards teaching profession of the pre-service teachers in the experimental group were higher than the average of their peers in the control group. According to this finding, it can be said that the experimental method (Hyflex Technology-Based Learning) was effective in improving pre-service teachers' attitudes towards teaching.

Table 6. Comparison of Post-test Attitude towards Teaching Profession Scores of Experimental and Control Group Pre-service Teachers

	Group	N	Mean	Std. Deviation	t	p
Post-attitude	Control	32	3.33	0.28	-2.04	0.05
	Experimental	32	3.51	0.42		

Discussion and Conclusion

The effects of 'Hyflex Technology Based' learning on pre-service teachers' academic achievement in formation courses, retention of learning and attitudes towards teaching profession were examined. According to the findings of the study, the students in the experimental group who were exposed to hybrid Hyflex Technology-based Learning approach achieved higher academic achievement and learning retention compared to their peers in the control group who were exposed to traditional instruction. These findings are similar to the findings of the studies conducted by Bell et al. (2013), Beatty (2019), Bower et al. (2019), Cano (2022), Dankers and Stoltenkamp (2022), Leijon and Lundgren (2019), Lujaro (2010), Szeto and Cheng (2014). It is thought that combining traditional face-to-face education with online learning activities within the scope of Hyflex Technology, known as "blended learning method" in the education and training literature, is the most effective learning method for the target group. Moreover, the technological foundation on which this method is based is expected to be an appropriate tool to support the learning process in an efficient, effective and satisfying way. Such an instructional practice brings about a certain degree of change in the pre-service teachers' thoughts and practices.

Students engaged in collaborative learning activities and teachers who abandon their traditional roles and assume the role of "facilitators" constitute the basic components of a constructivist, student-centered learning environment. The opportunity to access information, which in the past was under the control of teachers, has expanded its scope and now also benefits students. In fact, new technologies, which are in constant development, have enabled students to access information within seconds during class (Lujara, 2010). Online learning based on Hyflex Technology is not only based on the use of smart devices, learning resources, specific learning or teaching communities within a strategic plan, but also on a thorough understanding and application of learning and teaching methods that "enhance" the learning environment for different educational needs (Paudel, 2021; Wiley, 2000; Xhelili et al., 2021). In this respect, 'Hyflex Technology-Based Learning' practices in formation education positively and highly affected the academic achievement and learning retention of pre-service teachers.

Educational institutions that want to get the maximum benefit from blended synchronous 'Hyflex Technology-Based Learning', which will bring more flexible access to programs, high quality learning experiences, and an increased sense of connectedness, need expert teachers who receive technical assistance, instructional support, have completed their professional development, can adapt to automatic teaching times, and have gone through a certain preparation process. When the practices are analyzed, it is seen that blended synchronous 'Hyflex Technology-Based Learning' designs result in a more active learning experience. The majority of both traditional face-to-face and distance students reported that they learned at least as much in the blended synchronous learning course as they did in face-to-face courses.

'Hyflex Technology Based Learning' allows teachers and students to utilize a variety of tools to access the e-Classroom using interactive ITS conferencing software applications such as Zoom to enter the e-Classroom environment and communicate via chat or web page, course document and whiteboard sharing. This situation, on the one hand, improves the technical skills of pre-service teachers, and on the other hand, the rich learning environment and platforms provided positively affect the level of course learning. In summary, the rules and

principles set for 'Hyflex Technology-Based Learning', instant teacher feedback through various tools, a sense of community, and the immediate engagement of various types of activities, assessments and assignments contributed to the high achievement levels of the pre-service teachers.

Another problem addressed in the research is the effects of the applications in the experimental and control groups on the professional attitudes of pre-service teachers. According to the findings of the study, the students in the experimental group, in which the hybrid 'Hyflex Technology-Based Learning' approach was applied, developed more positive attitudes towards the teaching profession compared to their peers in the control group, in which traditional teaching was applied. These findings are similar to the research findings of Orhan, Altun & Kablan (2004), Bailey (2002), Bell, Sawaya & Cain (2014), Lujaro (2008), Leijon & Lundgren (2019), Malczyk (2019), Miller, Risser & Griffiths (2013), Szeto & Cheng (2014), Şimşek (2009). Orhan, Altun, and Kablan (2004) examined the views of the students who took part in blended teaching practices at the higher education level. At the end of the research, they concluded that the majority of students did not prefer to take courses only in face-to-face teaching environment or only in Web environment, and half of the students preferred blended learning environment. Şimşek (2009) examined the effect of blended learning method on physics teacher candidates' attitudes towards computer, internet and web-based teaching. As a result, it was determined that blended learning had a significant and positive effect on physics teacher candidates' attitudes towards computer, internet and web-based teaching in both applications. Bailey (2002) examined the satisfaction and interaction perceptions of students in blended learning and distance learning environments. As a result of the study, students in the blended learning environment expressed that they had a slightly higher level of satisfaction than students in the distance learning environment.

On the other hand, some researchers (Lujaro, 2008; Szeto & Cheng, 2014) emphasized that in the adoption of blended concurrent learning, teachers need time to set boundaries and implement the agreed methods, while students need time to accept and assimilate the adopted approach. Instructional support has also been shown in some studies (Bell et al., 2013) as a critical point to be considered. According to the observations of the researcher involved in the experimental implementation process of this study, the development of 'Hyflex Technology-Based Learning' needs active learning support and provides flexibility in improving the quality of student experience in university classrooms. In addition, a framework for a multimedia-mediated, student-oriented learning environment was created as a guideline for instructors and pre-service teachers to adopt. Based on the 'Hyflex Technology-Based Learning' approach, this framework combines a robust structural model and creative media content to be integrated into a student-centered learning environment to keep pre-service teachers motivated and engaged throughout their learning process.

Based on the results obtained from the research, when developing 'Hyflex Technology-Based Learning' programs, care should be taken to ensure that they meet the expectations and needs of pre-service teachers. These programs should be of a quality that will help pre-service teachers to develop many aspects such as teaching competence, problem solving, self-expression, developing their abilities, revealing their potential, increasing their ability to explore, using language correctly, working harmoniously in a community, being prone to teamwork, using information technology effectively. Above all, these programs should have qualities that will teach pre-service

teachers to use knowledge on their own, increase their ability to produce knowledge and teach them how to learn. Different researches should be carried out in different classes with different projects in the field of teacher training on 'Hyflex Technology Based Learning' and these researches should be supported. 'Hyflex Technology Based Learning' should be researched not only in the field of "Teacher Training" but also in other disciplines.

Notes

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