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The Effect of Using the Context-based Learning on Associating Subjects with Real-life Levels of the Pre-service Science Teachers

Fizik Öğretiminde Yaşam Temelli Öğrenme Kullanımının Fen Bilgisi Öğretmen Adaylarının Konuları Gerçek Yaşamla İlişkilendirme Düzeylerine Etkisi

Sema Altun-Yalçın[1] Paşa Yalçın[2]

[1] Prof. Dr., Erzincan Binali Yıldırım Üniversitesi, Eğitim Fakültesi, Erzincan, Türkiye
[2] Prof. Dr., Erzincan Binali Yıldırım Üniversitesi, Eğitim Fakültesi, Erzincan, Türkiye

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Sema Altun-Yalçın

Erzincan Binali Yıldırım Üniversitesi Eğitim Fakültesi, Fen Bilgisi Öğretmenliği Yalnızbağ/Erzincan

saltun_11@hotmail.com

Abstract: In the study, the effect of using context-based learning by the pre-service science teachers in teaching physics on their levels of associating the subjects with real-life was explored. According to this purpose, the associating levels of the pre-service teachers, educated with the context-based learning, with physics lesson, which is thought to be directly interrelated with matematik, and with music and sports lessons, which are not thought to be very related have been investigated. In the study, the applications were carried out with 30 pre-service science teachers, studying at the fourth class of the university, for one year. The study was experimental and the single-group pre-test post-test design, which is considered within the scope of weak experimental designs, in which data are examined considering effects of the experimental procedure on a single group using pre-test and post-test, were used. The data were collected with the help of open-ended questionnaires on context-based learning applications of learning areas. These questionnaires were prepared to determine the knowledge and developments of the participant pre-service teachers about the relationship between physics and real-life before and after the activities. The questionnaire prepared in line with the common opinions of the four science researchers with knowledge of qualitative researches consisted of the question as " Does the ……. learning area has the relationship with the real-life? If there is, write down all the usage areas you know and explain how it is used." At the end of the study, we found out that the pre-service science teachers associated the physics subjects with daily life easier, created new contexts and became aware of relationships that they were not aware of before. It can be claimed the skills of being aware of the physics in daily events, interpreting the events in terms of physics and understanding and interpreting the application areas of the laws of physics were developed.

Keywords: Context-based learning, mathematics, spor, music, physics subjects

Öz: Çalışmada; fen bilgisi öğretmen adaylarına yaşam temelli öğrenme kullanılarak fizik öğretimi gerçekleştirilmesinin onların konuları gerçek yaşamla ilişkilendirme düzeyleri üzerine etkisi araştırılmıştır. Öğretmen adaylarının fizik konularını müzik, matematik ve spor dersleri ile ilişkilendirme düzeyleri araştırılmıştır. Çalışmada, dördüncü sınıfa devam etmekte olan 30 fen bilgisi öğretmen adayı ile bir yıl boyunca uygulamalar gerçekleştirilmiştir. Çalışma deneysel nitelikte olup veriler deneysel işlemin tek bir grup üzerinde etkisinin ön-test ve son-test kullanılarak incelendiği zayıf deneysel desenler kapsamında ele alınan tek grup ön-test son-test desen kullanılmıştır. Veriler, öğrenme alanlarının yaşam temelli öğrenme uygulamalarına ilişkin açık uçlu anketler yardımıyla toplanmıştır. Bu anketler katılımcı öğretmen adaylarının etkinlikler öncesi ve sonrasında fiziğin gerçek yaşamla ilişkisi hakkındaki bilgilerini ve gelişimlerini belirleyebilmek amacıyla hazırlanmıştır. Nitel araştırma konusunda bilgi sahibi dört fen eğitimi araştırmacısının ortak görüşleri doğrultusunda hazırlanan anket her bir öğrenme alanı için"……öğrenme alanının gerçek hayatla ilişkisi var mıdır? Varsa bildiğiniz tüm kullanım alanlarını yazarak nasıl kullanıldığını açıklayınız." şeklindeki sorudan oluşmaktadır. Çalışmanın sonucunda; fen bilgisi öğretmen adaylarının fizik konularını günlük yaşamla daha rahat ilişkilendirdikleri, yeni bağlamlar oluşturdukları ve daha önce farkına varmadıkları ilişkilerin farkına vardıkları tespit edilmiştir. Günlük olaylardaki fiziğin farkına varma, olayları fizik açısından yorumlayabilme ve fizik kurallarının uygulama alanlarını anlama ve yorumlama becerilerin geliştiği söylenebilir.

Anahtar Kelimelers: Yaşam temelli öğrenme, matematik, spor, müzik, fizik dersi konuları

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Introduction

Physics, which is one of the basic sciences, has great significance for countries to produce science and technology (Turgut et al., 2006). It is also necessary for the students to get a proper physics education, to capture the meaning and importance of physics and to develop themselves in the field of physics so that the countries can take part in the economic and scientific race and competition with other countries (Dupe, 2013). To provide this, an effective and permanent physics education should be given. For this, primarily, it is necessary to destroy the prejudices of the students towards physics. Physics is considered by the students to be the most difficult, most boring and most disliked subject. The reasons for this are that the physics subjects and content are composed of abstract concepts, students' prior knowledge is insufficient (Timur et al., 2016) and the failures they had experienced (Scott et al., 2016) inadequacy of students' mathematical knowledge and skills (Bayrak & Bezen, 2013), their negative attitudes towards physics lesson (White & Tyler, 2015), the methods applied in teaching physics lesson (Elby, 1999), the fact that not associating it with daily life, materials and tools used during courses, teachers' approach (Winter, 2013) and their lack of adequate preparation to teach the course (Ketola, 2011), and students' academic self-confidence levels (Dupe, 2013).

Some recommendations of solutions are given in the studies to eliminate these situations. Primarily, students' interests should be increased to realise a more effective physics teaching (Whitelegg & Parry, 1999). Students' motivations towards science decrease from the moment they begin primary school. To prevent this, pre-school science education should

be taken care of (Slavin, 2003). The situations in which the teacher constantly talks about the subject and the student listens passively influence students' interests and motivations more negatively (Lawrenz et al., 2009). To eliminate this, teachers should tend to create a fair, reliable, self-sacrificing and understanding environment where teachers have closer and more positive relations with students (Blickenstaff, 2004). In addition, to develop the students' academic self-confidence, it should be provided that they are faced with cases in which they will experience a sense of achievement in the courses, that they experience a sense of achievement, that they are proud of themselves and that their academic achievement increases (Götz et al., 2010). It is necessary to create learning environments that will ensure students' active participation in the courses, entertaining and meaningful learning and for this, to apply the current education technologies (Scott, 2016). Furthermore, the collaborative learning method, where they can realise peer learning, can be applied (Hanze & Berger, 2007). Experiments and activities that provide learning by doing can be applied greatly (Kanlı, 2013) and a conducive classroom environment that makes it more practical and interesting can be created (Dupe, 2013). The context-based learning approach can be used to help students comprehend the relationship between physics and daily life, where and how physics is used in daily life, and most significantly, to eliminate the perception of "how shall I benefit from physics" (Su & Güneş, 2015). Thanks to context-based learning, students will be able to correlate physics subjects with life. They will learn the examples and application areas of topics and concepts in daily life (Ayvacı & Bebek 2018) and it will create awareness and consciousness that physics is intertwined with daily life (Wieringa, Janssen & Van Driel, 2011). As context-based learning provides meaningful and permanent learning, it is crucial to be applied in physics teaching. Because, one of the main problems in physics teaching is the deficiencies in their prior knowledge (Timur et al., 2016).

The context-based learning is called in the literature as the "contextual approach", "contextualized approach", "context-based approach", "context-based teaching" and "context-based learning" (Schwartz, 2006) or "real-life applications", "real-life learning" (İlhan, 2010), "real-life problem", "real-life context", daily life, real-world, realistic etc. (Mosvold, 2005). Context-based learning is associating the topics to be learned from the individual's own experiences, the society, culture, social and physical environment in which the individual lives (Whitelegg & Parry, 1999). Thus, it will ensure the students establish relationships between the topics and their lives. The students will perceive the subjects more concrete and understandable (Bennett et al., 2002; Christensson & Sjöström, 2014). Because, context-based learning focuses on the contextualisation of the subjects with the real lives of the students (Ayvacı & Yamaçlı, 2023; Gilbert, 2006). Students learn the subjects through contexts and with this, they attribute new meanings to the context (Pilot & Bulte, 2006). These contexts can be likened to a rope. What strengthens the rope is the interaction and integrity of these yarns as well as the strength of the yarns it is formed from (Finkelstein, 2001). To provide this, that is, so that students can establish durable and interactive contexts, this knowledge, which is learned from an event, situation or problem in daily life, becomes a necessity. Thus, concepts and relations are used as means in solving or making sense of these events (Barker & Millar, 1999; Elmas & Eryılmaz 2015; İlhan & Hoşgören, 2017). As it is applied in physics lessons, the individual reconciles the subjects of physics with daily life and thus concretises them. Thus, they gain the ability to understand, assimilate, analyse and interpret physics in a more comprehensive and in-depth manner (Topuz et al., 2013). Context-based learning is not only learning the subjects, it is, at the same time, significant for the cognitive development of the individual (Komalasari, 2016). The individual's scientific process skills, creativity, problem-solving, questioning, research, reasoning, observation, career planning and relationship building skills develop (Derman & Badeli, 2017; Yıldırım 2015). To provide this, it is necessary to ensure the integration of life-based learning into learning environments in accordance with its purpose and as necessary. Providing this integration is the duty of teachers (Ayvacı & Bilge, 2018; Topuz et al., 2013). It is necessary for teachers to get a good education on this teaching method and to have knowledge and experience to apply it in the teaching environments (Kabuklu, Yüzbaşıoğlu & Kurnaz, 2019; Kurnaz, 2013). However, it was determined that teacher and pre-service teachers did not have sufficient knowledge and experience in context-based learning. This case will reflect negatively on the teaching environments they will create. To eliminate this case, pre-service teachers and teachers should get an education based on the context-based learning (Altun Yalçın et al., 2017; Ültay, Ültay & Dönmez Usta, 2018). In the present study, physics teaching was tried to be implemented by using context-based learning to pre-service science teachers, who will the teachers of the future. Thus, it is aimed that pre-service teachers both experience the context-based learning approach one-to-one and reconcile the subjects of the physics course, which they will teach in the future, with other fields. According to this purpose, the effect of using the context-based learning applications with pre-service teachers' associating the physics course with mathematics, sport and music lessons (learning areas), that is their context formation levels, was explored. The reason why these learning areas were selected was that physics lesson has a one-to-one relationship with the mathematics learning field, that is, they can easily relate, but it is perceived as not in close relationship with sports and music learning fields. Therefore, it was tried to reveal how the students' level of reconciling the physics lesson with the lessons that are thought to have different levels of relationship with the physics lesson was affected.

Method

Study Pattern: The weak experimental design was applied in the study. In the weak experimental design, the effect of the experimental procedure is tested in a study on a single group. Subjects' measurements related to the dependent variable is obtained with the same measurement tools as the pre-test before the application and the post-test after the application (Yıldırım & Şimşek, 2008).

The study is experimental and the single-group pre-test post-test design, which was considered within the scope of weak experimental designs, in which the data were examined using pre-test and post-test the effect of the experimental procedure on a single group, was applied (Büyüköztürk et al., 2010). As the study continued for one year, as it was thought that it would be difficult to keep the variables under control in the control group, the study was carried out on a single group. The study was carried out with 30 pre-service science teachers. The proper sampling method (Büyüköztürk, 2011), among the purposeful sampling methods, was used especially in order to prevent loss of time and labour in determining the sample. The reason why the study group was selected from the students in

the fourth class of the university was that they are about to complete their pre-service education and that they will be able to practice the teaching profession when they meet the necessary conditions one year later.

Data Collection Tools: The data were collected with open-ended questionnaires related to the context-based learning applications of the learning areas. These questionnaires were developed to determine the knowledge and developments of the participant pre-service teachers related to the relationship between physics and real-life before and after the activities. The questionnaire, prepared according to the common opinions of four science education researchers who were educated in the qualitative study, consisted of the question "Does the ……. learning area have a relationship with real life? If there is, write down all the usage areas you know and explain how it is used."

Practice: Since the research includes the participants who will teach at the primary education level with the start date of the project, examples, activities and practices that relate the learning areas in the textbooks, resource books and guidebooks that the participants should study at these grade levels with real life were carefully examined. As a result of this review, it has been tried to include practices that are parallel to the existing activities but at the same time will diversify these activities with different points of real life as much as possible. In addition, researchers have written new applications in accordance with the purpose and considering the mentioned points.

This study was implemented with the application of context-based learning practices prepared for two different learning areas to the pre-service teachers. The process of determining the context-based learning applications, first of all, started with scanning the existing literature in accordance with the purpose of the study and selecting the relevant applications and creating a pool. As the study consisted of the pre-service teachers who would work at the levels of five, six, seven and eighth classes, the examples, activities and practices that allow pre-service teachers to create contexts that relate learning areas in textbooks, resource books and guidebooks to real life that they need to process at these class levels have been carefully reviewed. At the end of this review, it was tried to include applications parallel to the existing activities but at the same time that will diversify these activities with different points of real life as much as possible. In addition, even the researchers created new applications appropriate to the purpose and considering the mentioned points.

- Do the context-based learning applications selected from the pool and the applications written by four researchers fully consist of the learning areas?
- Does it have the characteristics to uncover the correlation of learning areas with real-life/context creation capacity?
- Was the meaning expressed clearly and understandably?
- Can it be performed in terms of time and available materials?
- Does it allow the pre-service teachers to comprehend the various relationships between learning areas and real life?

The application days were determined considering the suitable time for the pre-service teachers and researchers for each activity and the pre-service teachers were ensured to participate by announcing the days. The context-based learning applications realised for each course were named with that course. Thus, totally three activities were implemented related to the learning areas. As the learning areas, mathematics, which is the area that is most used in physics lessons, the areas of sport and music, which have a significant place in students' lives, were selected. Thus, the activities in music and sports areas, that include the universal values for all of the students both in different cultures and different ages and in mathematics were performed. Approximately four-five hours of duration was given for each of the activities. Throughout the applications, the pre-service teachers worked in groups consisting of four or five people.

Collecting and Analysing the Data: The pre-service teachers were brought together in a classroom environment to determine their preliminary knowledge and to prevent the possibility of benefiting from different sources. The open-ended questionnaires were applied to the pre-service teachers relevant to their learning areas before the applications. Similarly, the data collection process was completed after providing the pre-service teachers to fill in the same questionnaires in two days determined after the activities and to analyse the collected data easily, they were transferred to the computer environment. The qualitative data gathered from the open-ended questionnaires were subjected to descriptive analysis. The concepts expressed by the pre-service teachers between the learning areas of physics and the context-based learning applications were determined directly, then, they were brought together under the codes-categories to present the findings more regularly and described with the determined frequency values. Firstly; in the study, qualitative data were analyzed by 3 experts in the field of education (researchers) at different times and independently of each other. Finally; the analysis process was carried out with simultaneous work and codes and categories were created by the three researchers. As a result of the analysis, the reliability coefficient was found to be 0.88. The answers given by the pre-service teachers were presented and the three researchers stated their thought about which aspect of real-life these expressions was relevant. When they reached a consensus, that category and code were taken as it was; on the other hand, when a common point was not reached, the final decision was made by a majority of votes. Therefore, the meanings of the categories and codes in the study in terms of common features were created. The information related to how each category and code was formed was explained in more detailed in the findings section.

The data obtained from the open-ended questionnaires applied to the pre-service teachers related to their learning areas were subjected to the content analysis. The analysis of the data obtained from the open-ended questionnaires was started by transferring the collected questionnaires to the computer environment. Then, these data were subjected to the analysis by the three researchers separately for each question and divided into codes, categories and themes. Next, the three researchers came together and tried to reach a consensus relevant to the codes, categories and themes. In the face-to-face meetings, discussions were made on the points where there was a disagreement, and a consensus of 90% was achieved in general. In some cases, a fourth expert participated in the discussions and helped finalize the codes and categories.

Table 1. Physics and mathematics qualitative data analysis

	Categories	Codes	Pre-questionnaire Frequency	Post-questionnaire Frequency
PHYSICS AND MATHEMATICS	Function of mathematics	Calculation	15	22
		Numbering	-	1
		Physics Practise	-	1
		Proving	-	3
		Concretisation of the Data	-	1
		Ability to Identify	-	1
		Providing the formulation	-	2
		Counting	-	1
		Concluding	-	1
		Drawing	-	1
		Solving problems	8	2
		Mathematics concretises physics	1	-
		Measurements	3	-
	Relationship between them	No physics without mathematics.	2	5
		Helper	-	3
		Inseparable	12	10
		Not related	1	
	Applied mathematical concepts	Numbers	-	4
		Measurements	-	1
		Figures	-	1
		Angle	-	5

Erzincan Binali Yildirim University Human Research Ethics Committee's decision numbered 06-15 taken at the session numbered 06 dated 31/05/2021 and ethics committee document with document number E-85748827-050.06.04-82996 were obtained.

Findings

The findings reached from the analysis of the answers given for the relationship between mathematics and physics by the pre-service teachers are presented in Table 1.

As Table 1 is analysed, it is seen that the pre-questionnaire data consist of two and post-questionnaire data consist of three categories in this study in which the relationship between mathematics and physics was explored.

In this study, in which the relationship between mathematics and physics was explored, the pre-questionnaire data consisted of two categories and the post-questionnaire data three categories. The pre-questionnaire and post-questionnaire data include the function of the mathematics category. The pre-questionnaire data consists of four codes and a total of 27 frequencies. The frequency of solving the problems code is five, the pre-service teachers stated that mathematics was used to solve the problem in the problem part of physics and that mathematics constituted the problem part of physics. The frequency of mathematics concretises physics code is one. The code of solving the problem has eight frequencies and calculating has 15 frequencies. In the post-questionnaire, the "function of mathematics" category that is formed with the answers of the pre-service teachers consists of 11 codes. These codes are calculating, numbering, physics practise, proving, concretising the data, proof, ability to express, providing the formulation, counting, concluding, drawing and solving the problems. The pre-service teachers claimed that mathematics constitutes the calculation function of physics, provides the numbering process of physics, provides the proof of the laws of physics, contributes to the concretisation of physical data, physics can be expressed through mathematics, provides the formulation of physics, and that the things that need to be counted in physics can be counted via mathematics. In addition, they stated that mathematics helps physics, physics reaches the results with mathematics, the necessary drawings in physics are performed with the help of mathematics and provides the solution of physics problems. Furthermore, the pre-service teachers stated that physics uses mathematics in measuring, mathematics is used in calculating and physics uses the four operations of mathematics.

Some examples of pre-service teachers' answers: "Physics makes calculations using mathematics and makes life easier", "We try to solve all the most difficult problems in physics with the help of mathematics", "Mathematics is used in calculations, numbering, naming." It can be claimed that they think that mathematics serves the calculation process of physics (calculation code) and that mathematics assumes the operation function of physics (operation code) in the relationship of mathematics with physics.

The pre-questionnaire and post-questionnaire data consist of the category of "the relationship between them." The relationship between physics and mathematics consists of three codes and a total of 16 frequencies in the pre-questionnaire, this is three codes and a total of 18 frequencies in the post-questionnaire. The pre-questionnaire codes are no physics without mathematics, inseparable and not related. The post-questionnaire codes are no physics without mathematics, helper and inseparable. As the answers in this category were analysed in general, they stated that mathematics and physics are complementary fields, they cannot be considered separately, and even without mathematics, physics would not exist. Some of the examples of pre-service teachers' answers are "they cannot be separate from each other, they are always two branches of science connected", "mathematics and physics are interrelated", "Without mathematics, physics would be incomplete and never complete."

The "used mathematical concepts" category that the post-questionnaire data constituted consists of four codes. These codes are numbers, measurements, figures and angles. The pre-service teachers stated that physics uses mathematics concepts.

Table 2. Physics and Music qualitative data analysis

	Music	Pre-questionnaire	Frequency	Frequency
PHYSICS AND MUSIC	Musical Instruments	Making the musical instruments	2	32
		Getting sound from the musical instruments	-	4
	Physical Concepts	Sound-related terms	10	43
		Wave-related terms	-	8
		Motion Force	2	3
	Physics-used Areas	Beats	1	-
		Singing song	2	1
		No physics in music	2	-
		Creating notes	1	1
		Tuning	-	8
		Sound insulation	-	2
		Rhythm	1	4
		Sound	20	19

Findings reached according to the analysis of the given answers of the pre-service teachers to the relationship between physics and music are presented in Table 2.

As Table 2 is analysed and when the answers of the pre-service teachers to the question where the physics topics are used in music are examined, the pre-questionnaire and post-questionnaire data consist of two categories. The categories are the physical concepts and physics-used areas and musical instruments.

When the answers of the pre-service teachers to the question where the physics topics are used in music are examined, the pre-questionnaire and post-questionnaire data consist of two categories. The categories are the physical concepts and physics-used areas and musical instruments.

The answers of the pre-service teachers to the pre-questionnaire and post-questionnaire consisted of the category of the physics-used area. It was observed that the pre-service teachers used the physical terms frequently to explain the physics in music. The category of physics-used areas of pre-questionnaire data consisted of 6 categories and 27 frequencies in total. The pre-questionnaire data of this category consisted of beats, creating notes, rhythm, singing song, no physics in music and sound codes. The post-questionnaire data consist of six codes and 35 frequencies. These codes are singing song, creating notes, tuning, sound insulation, rhythm, vocalisation of the notes and sound. The pre-service teachers' thoughts of creation of sound, hearing sound, providing sound insulation, creating rhythm, the force our breath exerts on the air when we sing and the force during the beats consist of this category. The answers of the pre-service teachers are “The sound waves are formed by physical methods”, “Sound is the basis of music”, “Bass, treble, wave, echo, beats, frequency, resonance demonstrate that music has something to do with sound, that is, physics”, “There are notes that allow different rhythms to be born thanks to sound and vibration.”

The answers of the pre-service teachers consisted of the category of musical instruments in both questionnaires. The data in the pre-questionnaire consisted of the making musical instruments category; on the other hand, the data in the post-questionnaire consisted of making the musical instruments and getting sound from the musical instruments. The total frequency of the pre-questionnaire data in this code is two; the total frequency of the data in the post-questionnaire is 36. The pre-service teachers' opinions constituting this code are the stretch of the drum's leather, the shape of the drum's leather, the length of the strings of the stringed instruments, the thickness of the strings, the stretch of the strings, what is used to strike while striking in percussion instruments, the vibration of the air when the ney is blown, the type of ney reed, the width and location of the holes drilled in the ney reed. The answers of the preservice teachers are "It would be unfair to say that the skin used in percussion instruments, such as drums, is taut and lacks physics while creating its volume and shape", "The formation of these notes is due to stretch."

While the pre-questionnaire data consist of the physical concepts category with two codes and 12 frequencies in total, the post-questionnaire data consist of three codes and 54 frequencies. The codes of physical categories are sound-related terms, wave-related terms and motion force. The pre-service teachers used the physical concepts in explaining the use of sound learning areas in daily life. The physical concepts that they used are resonance, frequency, transmission, sound intensity, sound energy, rhythm, vibration, force, motion, decibel, period, wavelength, amplitude, echo, sound intensity and impact reaction force etc.

The analysis of the data related to Physics and Sport and the relationship between the qualitative data analysis.

When the answers of the pre-service teachers to the question of where is the physics lesson used in sport are analysed, the pre-questionnaire data consist of two categories and the pos-questionnaire data three categories. The pre-questionnaire categories are sport branches and physics-used areas and the pos-questionnaire categories are sport branches, physics-used areas and applied physical rules.

The category of sport branches takes place in both questionnaires. The pre-questionnaire and post-questionnaire data consist of nine codes. The pre-questionnaire codes are in each branch of sport, ball sports, shooting sports, race sports, water sports, running sports, ski sports, weightlifting sports and gymnastics. The post-questionnaire codes are ball sports, shooting sports, water sports, outdoor sports, race sports, jumping sports, martial arts, weightlifting sports and gymnastics. This category consists of the pre-service teachers’ answers to the questionnaires “swimming, table tennis, discus throw, archery, shot put, ice skating, javelin, shooting, basketball, football, jumping, rafting, parachuting, basketball, table tennis, handball, pole vault, athletics, volleyball, sailing, swimming, football, javelin, shot put, golf, baseball, riding." The answers of the pre-service teachers were "Physics in physical education is not only the football. Here, basketball, handball, volleyball, pole vault, running etc. have a significant role.", "That is, physical education can not be without physics.", "Physics is in every field such as a parachutist's jump, an athlete's run, a soccer ball and football players, basketball, volleyball, swimming."

Table 3. Physics and Sport and qualitative data analysis

	Categories	Codes	Pre-questionnaire Frequency	Post-questionnaire Frequency
PHYSICS AND SPORT	Sport Branches	In every branch of sport	1	-
		Ball sports	17	51
		Shooting sports	15	12
		Water sports	2	20
		Outdoor sports	-	1
		Race sports	3	1
		Jumping sports	-	5
		Running sports	2	-
		Ski sports	1	-
		Martial arts	-	1
		Weightlifting sports	1	4
		Gymnastics	1	2
	Terms	Physical terms	-	76
		Mathematical terms	-	5
		Passing	2	-
	Physics-used Areas	Sports equipment	8	-
		Decreasing speed	2	-
		Kicking the ball	1	-
		Shooting movements	-	5
		Shot	-	3
		Ball shot angle	-	1
		Making the basket	-	1
		The flexibility of the bar	-	1
		Ball bounce	-	1
		Dimensions of the fields	-	1
		Nascar tracks	-	1

It can be claimed that the pre-service teachers stressed the physical terms in their post-questionnaire answers. The terms category, that the post-questionnaire data consist of, includes two codes. It was determined that the pre-service teachers had used the physical terms to explain the physics in sport in the post-questionnaire. They used the physical terms (f:76), in addition, the mathematical terms used in physics (f:2) most. These expressions that the pre-service teachers gave to the questionnaire questions consisted of this category. They used the terms such as oblique shot, energy, power, friction, motion, horizontal shot. In addition, the pre-service expressed this category with the expressions such as the conversion of movement energy to heat energy, power and balance of vehicle engines, movements made by athletes, force to be applied to the ball, etc. It can be claimed that the pre-service teachers' use of the physical terms only in the post-questionnaire means to be aware of the physics in daily events, to interpret the events in terms of physics, and to understand and interpret the application areas of the laws of physics. The answers of the pre-service teachers were as “Force and motion are used”, “There is balance and moment. There is thrust momentum. Centrifugal and centripetal acceleration are used in throwing the shot put.", "Force and angle are used in the javelin, there is oblique throw motion free-fall motion", "Physics, motion, energy, force, friction, simple machines, etc. used together in sport."

The pre-questionnaire and post-questionnaire data of the pre-service teachers consist of the “physics-used areas” category. While the pre-questionnaire data occur from four codes and 13 frequencies, the post-questionnaire data consist of eight codes and 14 frequencies. The pre-service teachers stated in the pre-questionnaire that there was physics in sports equipment (8), passing (2), kicking the ball (1) and decreasing the speed (2). The pre-service teachers stated in the post-questionnaire that there was physics in shooting movements (5), shots (3), building Nascar tracks (1), dimensions of the fields (1), ball bounce (1), the flexibility of the ball (1), making the basket (1). The pre-service teachers used the expressions in this category such as the preparation of the fields by taking the frictions into account, how the football player applies to the ball at what angle and how much force, the characteristics of the place in the tab of the basketball ball etc. The sample answers of the pre-service teachers are as “Yes, it is used, in the simplest way, the dimensions of the football fields, the field lines, the length of the basketball hoop, or the construction is done with physics according to certain standards.”, “Adjusting the flexibility and stiffness of the bar at a certain rate in pole vault ensures the correct use of physical power and energy in sports.", "The centripetal force is utilized, as the vehicle engines are strong, balance is required, and the Nascar tracks are prepared according to the laws of physics in racing sports.", "Buoyancy of water in swimming, impact-reaction of hitting soccer ball, basketball bounce stretch and action-reaction."

Result and Discussion

At the end of the study, it was determined that the contexts created by the pre-service science teachers in all learning areas increased after the application. It was determined that the contexts they created in the field of mathematics learning increased by doubled up compared to the pre-application and that the contexts they created in the field of music learning and

sports learning increased approximately 3 times. At the end of the study, it was realised that pre-service teachers used more simple and limited descriptions in their statements before the practices and more detailed descriptions after the practices in associating learning areas with real life. It can be stated that the number of contexts, namely the frequencies, that the pre-service science teachers created after the applications increased, they began to create the contexts that they had not created before the study and they realised that the learning areas, that they did not consider to be related to physics before, were related to physics. In conclusion, it can be claimed that the pre-service science teachers became to understand, interpret and solve the relationship between mathematics and physics. These results are as follows based on learning areas:

As the associations of mathematics and physics by the pre-service teachers were analysed, it was determined that the pre-service teachers thought at the end of the application that mathematics was used in numbering in physics, in the processes of applying physics, proving, concretising data, expressing, formulating, counting and reaching conclusions. In addition, different from the pre-questionnaire, the pre-service science teachers stated in the post-questionnaire that physics uses the numbers, measurements, figures and angle terms of mathematics. Furthermore, they stressed specifically the function of mathematics in physics.

As a result of the association of sport with physics by the pre-service science teachers, it can be claimed that the pre-service science teachers increased the exemplifications in the issue of where and how are the physics rules are applied in the sport after the application. In general, it can be stated that the number of examples that the pre-service science teachers gave after the application was about twice and more detailed than the examples they gave before the application. In addition, as the pre-questionnaire and post-questionnaire data of the pre-service science teachers were compared, it can be claimed that the skills of being aware of the physics in daily events, interpreting the events in terms of physics and understanding and interpreting the application areas of the laws of physics have improved.

As a result of the association of music and physics by the pre-service science teachers, it was determined that they had stressed much on the sound-related terms in the content of the physics course. Besides, it was observed that they gave detailed and numerous examples that musical instruments were made in accordance with the laws of physics in applying physics in creating sound with the musical instruments. As it was examined in general, it was observed that the examples that the participants gave in the post-questionnaire in the issue of where is music used increased and they gave more detailed information. In addition, it can be claimed that their viewpoints on music and musical instruments have changed. It can be stated that they could realise physics in music and musical instruments and thus, their awareness of the topic of physics increased. According to this result, it can be claimed that the context-based learning applications develop the pre-service science teachers' skills of associating real-life / context developing. The result of this study is parallel to the results of the studies conducted by Bennett & Holman, (2002); Yıldırım & Gültekin, (2017); Stolk et al., (2012); De Putter-Smits et al., (2012); Valdmann, Rannikmae & Holbrook, (2016). The study conducted by Altun Yalçın et al., (2017) with the pre-service science teachers focused on the light and sound learning areas which are among the topics of context-based learning and physics. At the end of their study, they concluded that the levels of associating the light and sound learning areas with daily life by the pre-service science teachers increased. In the study by Özturan Sağırlı et al., (2016), it was found that the context-based teaching applications that they developed with the pre-service teachers created new contexts in which the pre-service teachers associated the topics with real life. As a result of educating with the context-based teaching applications, the associating frequencies of the pre-service teachers increased after the application compared to the before the applications; while the associations related to some fields were not established before the applications, they were established after the applications. In addition, while some of the pre-service teachers did not think that some learning areas were related to daily life before the applications, they realised that they were aware of the existed relationships after the applications. In the study by Yalçın et al., (2018); the applications were arranged with the context-based learning applications in the astronomy and electric learning areas of the physics subjects with the pre-service science teachers. As a result of the applications, it was found that the pre-service science teachers' association levels of the astronomy and electric learning areas with daily life increased and developed new contexts. In the study by Bennett et al., (2005), it was determined that context-based learning provided students' establishing relationship between science and real life. Individuals can answer traditional questions better than context-based questions (Sak & Kaltakçı Gürel, 2019). When individuals associate a concept, a topic with their culture, life and environment, effective learning realises (Yam, 2005) and academic achievement increases (Demircioğlu & Özdemir, 2019; Kara & Çelikler, 2019; Karagölge, Ceyhun & Arıcı, 2019; Karslı Baydere & Aydın, 2019; Kirman Bilgin, 2015; Sarıoğlu et al., 2021). While students are solving context-based questions and finding solutions While explaining, the students with high academic success generally benefited from scientific knowledge. Academic In general, the students with medium achievement find solutions to the students with high academic achievement. While explaining the questions, they used less scientific knowledge, while some explained the questions with their experience and have been found to have misconceptions (Nasırlıel & Ünal, 2021). Yıldırım and Gültekin (2017) suggest that the context-based learning approach increases the academic achievements, memorising levels and motivations towards science learning (Derman & Ergün, 2020). In addition, it is of great significance in terms of eliminating the misconceptions and lack of knowledge that they have related to the topics they will teach (Kistak 2014). From this point of view, teachers in the new learning environments they will design, especially those who have difficulties in learning (Kabuklu & Kurnaz, 2019). In teaching concepts, context-based teaching can be taken into account. Teaching environments created by teachers, who do not have a lack of knowledge, will also be more effective and productive (Çekiç Toroslu, 2011; Yel & Çetin, 2022). Teachers must have sufficient knowledge and experience not only in the topics they will teach but also in the teaching methods they will apply (Akın & İlhan, 2020). However, even this is not sufficient (Doğru & Çepni, 2023). Because, the variables such as teachers' views to the approach, dominance, level of prior knowledge, etc. are extremely significant. Teachers are biased due to the additional workload such as this teaching method necessitates to be prepared before the lesson, to prepare the contexts related to the subject before the lesson, to conduct the process with the teacher and student interaction. It is seen that some teachers even have a negative attitude

(Tatlı & Bilir, 2019). In the study conducted by Ulger, Ar & Sarıoğlu, (2022); Teachers were given in-service training and it was investigated how much they used context-based questions in exams. As a result of the study; they continued to ask mainly classical questions. Camouflage context-based questions. Although it is observed that it is frequently used, context-based questions are rarely encountered. The teacher training institutions should integrate a life-based learning approach into their curricula to eliminate this (Ketola, 2011; Sak & Kaltakçı Gürel, 2018). Because, in line with the theoric training given in the pre-service and in-service education, the pre-service teachers are insufficient in developing real-life-based problems and do not have sufficient knowledge in the topic of context-based learning (Ayvacı, Ültay & Mert, 2013; Obay & Çelik, 2019). Application-based training should be given (Ültay, 2017; İnci & Çubukcu, 2018) to them or they should get an education directly with the context-based learning (Yalçın et al., 2018). This situation the context development, which is perceived as the most difficult part of life-based learning by teachers, that is, associating with life will be prevented (Gürsoy Köroğlu, 2011). It is of great importance for the pre-service teachers to receive one-to-one training with the teaching methods, to better understand the steps of that teaching method, to apply them more comfortably in teaching environments in their professional lives, and to easily solve the problems they will encounter during these applications (Çakır & Altun Yalçın, 2020). In addition, it will help pre-service teachers' learning the concepts and topics better (Can, 2017) and their creating contexts and diversifying the contexts (Kara, 2016).

Recommendations

In the present study, how much do the pre-service science teachers associate learning physics topics with the context-based learning approach and can associate their subjects to daily life was explored. At the end of the study, it was determined that the pre-service teachers could more easily associate the physics topics with daily life, developed new contexts and became aware of the relationships that they had not been aware of before. This situation is thought to have influenced the pre-service science teachers' associating the learning environments with daily life positively in their professional lives. It is significant for teachers and pre-service teachers to get training of these sorts of teaching methods not only theoretically but also practically or one-to-one with that teaching method. Thus, they can learn the role of students in that teaching methods by living directly and they can better understand the effect of the attitudes, behaviours and applications of the people who apply the practice, that is, the teachers, on the students. In line with this point of view, the biggest task belongs to the education faculties, academicians and in-service training courses. It is of great significance that current and effective methods and approaches should be integrated into the courses in the faculties of education. This situation is not only crucial for the pre-service teachers' integration of these teaching methods in their professional lives but also the realisation of meaningful and permanent learning.

Author Contributions

All authors equally took part in all processes of the article. All authors had read and approved the final version of the work.

Ethical Declaration

Erzincan Binali Yildirim University Human Research Ethics Committee's decision numbered 06-15 taken at the session numbered 06 dated 31/05/2021 and ethics committee document with document number E-85748827-050.06.04-82996 were obtained.

Conflict of Interest

The authors declare that there is no conflict of interest with any institution or person within the scope of the study.

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