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Preservice Science Teachers' Metaphorical Perceptions Related to "Technology" Concept*

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Fen Bilgisi Öğretmen Adaylarının "Teknoloji" Kavramıyla İlgili Metaforik Algıları*

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Abstract

How preservice science teachers perceive technology is significant because we cannot think science and technology separately. Using metaphors is one of the method helps to examine how a concept, technology in this contect, is perceive. A metaphor can be defined as the process of defining a less known concept by using a more known concept and explaining why it is defined that way. Accordingly, the aim of this study was to examine preservice science teachers' metaphorical perceptions related to the technology concept. This study was conducted with 110 volunteer undergraduate preservice science teachers from a state university in Western Türkiye. As a methodology, phenomenology was selected from qualitative research. For data collection process, participants fill in the blanks: "technology looks like …….. because ……..". Data was analyzed by using content analysis. All collected data was categorized as positive (N=83), negative(N=15), and neutral(N=12) in the first phase. Positive codes were found as useful, developing, changing, need, unlimited, helpful, valuable, source of information, facilitating, enlightening, widespreading and guiding. Negative codes were found as addictive, harmful, and endless. Lastly, neutral codes were found as balance and variability. According to the general findings of this study, preservice science teachers' perceptions related to the technology was mostly positive. However, negative perceptions relied on addictiveness of technology can be harmful. Preservice science teachers' neutral perceptions both expressed negative and positive sides of the technology. By considering the technology integration in education, it is thought that examining preservice science teachers' metaphorical perceptions are important and more studies need for the future.

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Fen Bilgisi Öğretmen Adaylarının "Teknoloji" Kavramıyla İlgili Metaforik Algıları

Öz

Günümüzde fen bilgisi ve teknolojiyi birbirinden ayrı düşünemeyiz. Bu sebeple geleceğin fen bilgisi öğretmenlerin teknoloji ile ilgili algılarının incelenmesi önemlidir. Teknoloji kavramıyla ilgili metaforik algılarının incelenme yöntemi olarak metaforlar kullanılmıştır. Metafor daha az bilinen bir kavramı bilinen bir kavramı kullanarak tanımlama ve neden bu şekilde tanımlandığını açıklama sürecidir. Bu sebeple bu araştırmada fen bilgisi öğretmen adaylarının "teknoloji" kavramına ilişkin metaforik algılarının belirlenmesi amaçlanmıştır. Çalışma Türkiye'nin batı bölgesinde bir devlet üniversitende öğrenim görmekte olan fen bilgisi öğretmen adaylarıyla yürütülmüştür. Çalışmaya gönüllü olarak katılmak isteyen 1., 2., 3., ve 4. sınıf olmak üzere toplamda 119 fen bilgisi öğretmen adayı katılmıştır. Çalışmanın yöntemi olgubilim (fenomenoloji) seçilmiştir. Araştırmanın veri toplama sürecinde "teknoloji" kavramına yönelik metaforik algılarının belirlenmesi amacıyla "teknoloji ……. gibidir, çünkü ……" ifadesini tamamlamaları istenmiştir. İfadede yer alan veriler içerik analizi yöntemi kullanılarak analiz edilmiştir. Analiz sonucunda ortaya çıkan 74 kavram, olumlu, olumsuz ve nötr metaforik algılar olarak kategorilere ayrılmıştır. Bu kavramların 56sı olumlu, 7si olumsuz ve 10u nötr olarak kategorileşmiştir. Daha sonra bu ayrılan kategorilerin kendi içerisinde kodları bulunmuştur. Olumlu kodlar yararlı, gelişen, değişen, ihtiyaç, sınırsız, yardımcı, değerli, bilgi kaynağı, kolaylaştıran, aydınlatan, yaygınlaştıran ve yön veren olarak kodlara ayrılmıştır. Olumsuz kodlar ise bağımlılık olarak kodlanmıştır. Nötr olan algılar ise hem iyi hem kötü olarak kodlanmıştır. Bu çalışmanın bulgularının geleceğin fen bilgisi öğretmen adaylarının teknolojiyle ilgili metaforik algılarını yansıttığı düşünülmektedir. Teknolojinin eğitimdeki önemi düşünüldüğünde, gelecekte de teknoloji kavramına yönelik metaforik algılarının incelenme çalışmalarının sürdürülmesinin önemli olduğu düşünülmektedir.

Makale Bilgisi

Anahtar Kelimeler: metaforik algı, fen bilgisi öğretmen adayı teknoloji

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Giriş

Teknoloji, sağlık, endüstri, bilim ve eğitim dahil olmak üzere pek çok disiplinin hızla geliştiği bir alandır. Teknolojik gelişmeler, bireylerin hem günlük hem de mesleki yaşamlarını kolaylaştırmaktadır (Ertmer, 1999; Lai & Bower, 2019). Eğitim, teknolojiden en çok etkilenen disiplinlerden biridir (Ratheeswari, 2018). Çocuklar okuldan önce teknolojiyi video izleyerek ya da oyun oynayarak tanımaktadır. Bu nedenle, dijital vatandaşlar olarak tanımlanan bu neslin yaşamının her alanında teknolojiye ihtiyacı vardır. Teknoloji uygun bir şekilde kullanıldığında öğrencilerin motivasyonunu artırabilir, öğrenmeyi kolaylaştırabilir ve akademik başarıyı destekleyebilir (Butler et al., 2014; McKnight et al., 2016). Teknoloji ve bilimin birbirini etkileyen iki disiplin olduğu düşünüldüğünde, fen eğitiminin de bu gelişmelerden etkilendiği açıktır. Bu nedenle, fen bilgisi öğretmenlerinin ve öğretmen adaylarının sınıflarında teknolojiyi etkin bir şekilde kullanmaları gerekmektedir (Kennedy & Deshler, 2010; McKnight et al., 2016). Ancak, birçok öğretmen teknolojinin önemine rağmen sınıflarında kullanmaya direnç göstermektedir. Bu durum, özellikle öğretmenlerin teknolojiyle ilgili algılarının incelenmesini önemli kılmaktadır. Metaforlar, bireylerin algılarını ortaya çıkarmak için yaygın bir şekilde kullanılmaktadır (Ertmer, 2005). Bu çalışma, fen bilgisi öğretmen adaylarının teknoloji kavramıyla ilgili metaforik algılarını incelemeyi amaçlamaktadır. Önceki araştırmalar, teknolojinin olumlu ve olumsuz algılarla ilişkili olduğunu ortaya koymuştur (Bilgiç, 2021; Koç, 2013; Şanal, 2022).

Yöntem

Bu çalışma, fenomenoloji deseninde tasarlanmış bir nitel araştırma olarak yürütülmüştür. Fenomenoloji, bilinen ancak derinlemesine düşünülmeyen veya tam anlamıyla anlaşılmayan olguları betimlemeye odaklanır (Creswell, 2007). Araştırma, 2022-2023 akademik yılında Batı Türkiye'de bir devlet üniversitesinde gerçekleştirilmiş ve fen bilgisi eğitimi programına kayıtlı 160 öğrenciden gönüllü 110 fen bilgisi öğretmen adayı katılmıştır. Veri toplama aracı olarak iki aşamalı bir anket kullanılmıştır. Birinci aşamada katılımcıların demografik bilgileri (sınıf ve cinsiyet) sorulmuştur. İkinci aşamada ise şu tamamlanmamış cümle verilmiştir: "Teknoloji şuna benzer: ……. çünkü ……". Katılımcılar, ilk boşluğa teknolojiyle ilgili bir metaforik kelime veya ifade, ikinci boşluğa ise bu kelimeyi neden seçtiklerini açıklamıştır. Veriler hem nicel hem de nitel yöntemlerle analiz edilmiştir. Nicel analizde, demografik bilgiler ve metaforik ifadelerin frekans ve yüzdelikleri hesaplanmıştır. Nitel analizde ise içerik analizi uygulanmış ve metaforlar pozitif, negatif veya tarafsız olarak sınıflandırılmıştır. İki araştırmacının kodlama uyumu %92,50 olarak hesaplanmıştır (Miles ve Huberman, 1994).

Bulgular

Araştırmanın bulguları, fen bilgisi öğretmen adaylarının "teknoloji" kavramına ilişkin metaforik algılarının genelde olumlu (N=83), bazı durumlarda tarafsız (N=12) ve nadiren olumsuz (N=15) olduğunu ortaya koymuştur. Katılımcıların olumlu algıları, ağırlıklı olarak teknolojiye duyulan ihtiyaç (N=20), gelişme (N=19), değişim (N=11), değerli olma (N=7) ve aydınlatıcılık (N=6) kodlarında toplanmıştır. Örneğin, "Teknoloji suya benzer; onsuz yaşayamayız" ifadesi teknolojiye duyulan ihtiyacı vurgularken, "Teknoloji, ışık gibidir; hayatımızı aydınlatır" gibi ifadeler teknolojiye verilen değeri ifade etmektedir. Negatif algılar, teknolojinin olumsuz etkilerine odaklanmıştır. Örneğin, "Teknoloji zehir gibidir; fazlası zarar verir" ifadesi teknolojinin aşırı kullanımının zararlarını vurgulamaktadır. Katılımcılar, teknoloji bağımlılığı ve bilgi kirliliği gibi konuları da dile getirmiştir. Tarafsız algılar, teknolojinin hem olumlu hem de olumsuz yönlerini dengeli bir şekilde ele almıştır. Örneğin, "Teknoloji bir bıçak gibidir; doğru kullanılırsa faydalı, yanlış kullanılırsa zararlı olur" ifadesi bu duruma bir örnek oluşturmaktadır.

Tartışma ve Sonuç

Günümüzde teknoloji, eğitim de dahil olmak üzere birçok disiplinde yaygın bir şekilde kullanılmaktadır. Teknolojinin öğrenme ortamlarını kolaylaştırdığı ve etkinliğini artırdığı bilinmekle birlikte, bazı olumsuz etkileri hala tartışılmaktadır. Bu bağlamda, öğretmen adaylarının teknolojiye ilişkin algıları, teknolojinin eğitim ortamlarına entegrasyonu açısından kritik bir öneme sahiptir. Bu çalışmada fen bilgisi öğretmen adaylarının teknoloji kavramına yönelik metaforik algıları incelenmiştir. Bulgular, teknoloji kavramının ağırlıklı olarak olumlu bir şekilde algılandığını ortaya koymakla birlikte, olumsuz ve nötr algılara da rastlanmıştır. Öncelikle, bu çalışmada katılımcıların %75'inden fazlasının teknolojiye dair olumlu metaforlar kullandığı görülmüştür. Olumlu metaforlar genellikle teknolojinin faydalı, gelişen, ihtiyaç duyulan, sınırsız ve yönlendirici yönlerini vurgulamaktadır. Bu bulgu, teknolojinin öğretmen adaylarının hayatında önemli bir yer tuttuğunu ve sürekli gelişen bir alan olarak algılandığını göstermektedir. Diğer yandan, çalışmada teknolojinin olumsuz algılandığı durumlar da dikkat çekmiştir. Özellikle bağımlılık yapıcı ve zarar verici yönlerine vurgu yapılmıştır. Bu nedenle, öğretmenlerin teknoloji kullanımında dikkatli olması gerektiği ifade edilmektedir. Son olarak, çalışmada bazı öğretmen adaylarının teknolojiye hem olumlu hem de olumsuz yönleriyle yaklaştıkları, yani nötr bir algıya sahip oldukları görülmüştür. Bu durum, teknolojinin kullanım amacına göre farklı etkiler yaratabileceğini ortaya koymaktadır. Örneğin, "ilaç" metaforu, teknolojinin doğru kullanıldığında faydalı, ancak yanlış veya aşırı kullanıldığında zararlı

olabileceğini vurgulamaktadır. Bu perspektif, öğretmenlerin teknolojiyi eğitsel amaçlarla etkin bir şekilde kullanmaları gerektiğini göstermektedir (Ertmer, 2005). Sonuç olarak, teknoloji kavramı öğretmen adayları tarafından genellikle olumlu algılanmakla birlikte, nötr ve olumsuz algılara da rastlanmıştır. Kişisel deneyimler ve bireysel düşünceler, bu algıların şekillenmesinde önemli bir rol oynamaktadır. Öğretmen adaylarının nötr veya olumsuz algılarının, teknolojinin olumlu yönlerini deneyimlemeleri sağlanarak azaltılabileceği düşünülmektedir.

Introduction

Nowadays, technology is rapidly developing and growing in many disciplines including health, industry, science and education. Rapid advances in science and technology related tools make people's lives easier. For this reason, technology is implemented in individual's both daily and professional lives (Ertmer, 1999; Lai & Bower, 2019). Education, just like other disciplines, is one of the most affected disciplines from technological developments (Ratheeswari, 2018). Children are introduced to technology before they start school by watching videos or playing games. Since they are born in technology their generation is also called digital citizens. Digital citizens need technology in every aspect of their life. Since technology is continuing to develop, it can be stated that technology should be integrated into learning environments and classrooms. For this reason, educational also needs to integrate technology into the learning process. When technology used appropriately; it reinforces students' curiosity, increases motivation and facilitates learning (Butler et al., 2014; McKnight et al., 2016). Previous studies also support that technological integration improves academic success, motivation, attitude and perception (Erdoğan & Gök, 2008). Accordingly, teachers', whose use technology in classroom, attitudes and perceptions related to technology is important.

It is very important at this point how teachers will incorporate technological tools and equipment into their classrooms since they have positive thoughts, they tend to use technology more in classrooms (Wang et al., 2012). Technology and science are two related disciplines which affect each other. Therefore, science education is affected by scientific and technological developments. Accordingly, science teachers and preservice science teachers need to use technology effectively in their classroom. For an effective usage, they need to know media and methods in technology (Köseoğlu & Soran, 2005), have sufficient knowledge and skills related to technology (Kennedy & Deshler, 2010) and have positive attitudes regarding the technology (McKnight et al., 2016; Wang et al., 2012). Similarly, Lane and Lyle (2010) reported in their study that skills and positive experience related to technology are directly related to use in their classrooms. However, despite the many attempts to improve skills and explain the importance of technology in learning environments, most of the teachers, including science teachers and preservice science teachers, resist using technology in their classrooms. In order to investigate why this happens, it is necessary to examine what kind of perceptions they have related to technology (Smith, 2002; Ottenbreit–Leftwich et al., 2010).

Perceptions generally start being formed in daily life experiences by considering attitudes, beliefs, assumptions, thoughts, and conceptions (Pajares, 1992). At this point, this means that preservice science teachers have already have perceptions related to technology before they started to be a university. Metaphors are one of the most used ways to find out perceptions (Ertmer, 2005). "Metaphor" is the way that defining a less known concept by using more known concepts by explaining why they could be related (Jensen, 2006). For defining a concept by using metaphor personal experiences are a key factor. In other words, perceptions of newly learned or less known concepts are associated with past experiences, thoughts, ideas, and experiments (Arslan & Bayrakçı, 2006). Accordingly, Saban (2006) define metaphor as the relationships that abstract concepts establish in individuals' minds to concretize them.

In this study, the concept of "technology" as a metaphor was in abstract, theoretic and complex word to be defined. In order to define technology, well-known and concrete words will provide information about how individuals perceive technology in metaphorical way. In short, the concept of technology to be used as a metaphor in this study will provide concrete information about how preservice science teachers perceive technology in their minds. Previous studies conducted to reveal perceptions of technology by using metaphors stated that individuals both have positive and negative perceptions related to the technology (Bilgiç 2021; Koç, 2013; Şanal, 2022). In Bilgiç's (2021) study, preservice teachers from educational technology department state their metaphorical conceptions related to technology by relying on, its purpose, content, construct advantages and disadvantages. According to its results, it can be said that when technology used properly it helps to teaching and learning process. Similarly, in Şanal's (2022) metaphor analysis study, participants concentrated on process, material, necessity and approach categories related to the technology. Their metaphors revealed that technology is a broad and wide concept. In addition, Koç (2013) conducted a study with preservice teachers from different departments. In this study preservice teachers relate technology with these following categories, development, facilitation, power and threat. There was no differentiation between gender and undergraduate program.

Significance of the Study

Previous literature states that preservice teachers' metaphorical conceptions related to the technology is important since they will use technology in their future classrooms. On the one hand, previous studies concentrated on metaphorical perceptions with preservice science teachers have topics including the concept of science (Dönmez, 2017), STEM (Ergün & Kıyıcı, 2019; Sahin & Donmez, 2018; Zorluoglu et al., 2021), science laboratory (Ural & Basaran-Ugur, 2018), environment (Selçuk & Yılmaz, 2017; Yanarateş & Yılmaz, 2020). On the other hand, metaphorical perceptions

related to technology concept were conducted with preservice computer and instructional technology teachers (Dönmez-Usta et al., 2016), preservice preschool teachers (Korkmaz & Ünsal, 2016) and special education teachers (Şanal, 2022). Although the importance of technology in science education increases day by day, studies on examining preservice science teachers' perceptions related to the technology is limited. For this reason, the aim of this study is preservice science teachers' metaphorical perceptions related to the technology concept. With this aim, the following research questions were answered.

1. What are the metaphor perceptions of preservice science teachers' towards the concept of technology?
2. What are the conceptual categories of metaphors developed by preservice science teachers?

Methodology

Research Design

In this study, phenomenology research design was used from qualitative research methodologies. Phenomenography is a research design used in the process of describing the existing situation, experiences, or events (Yıldırım & Şimşek, 2008). In addition, this research design was purposively relying on the phenomena which we know but does not think or understand it in-depth (Creswell, 2007). Since in this study, preservice science teachers' metaphorical perceptions related to technology (the phenomenon) is examined, this research design was selected.

Participants

The study took place at a public university in Western Türkiye during 2022-2023 academic year. For sampling methodology convenience sampling was used. In this sampling methodology participants are a group of available individuals (Fraenkel & Wallen, 2003). The study was performed with 110 preservice science teachers among 160 students enrolled in the science education program. Participants were from first, second, third and fourth grade who want to participate voluntarily in this study. The distribution and demographic information about the participants were given at Table 1.

Table 1. Demographic Characteristics of Preservice Science Teachers

	Female	Male	**Total**
1st Grade	21	4	25
2nd Grade	20	2	22
3rd Grade	24	3	27
4th Grade	23	3	26
Total	88	12	**110**

Data Collection

In the study two step questionnaire is employed. In the first stage, preservice science teachers' demographic information (grade and gender) was asked. In the second stage preservice science teachers completed this sentence: "“Technology looks like …….. because ……..”. In the first blank preservice science teachers wrote a metaphorical word/phrase related to the technology. Then, in the second blank they wrote why they select this word/phrase by explaining and expressing their reason. This type of open ended opportunists enables to write their own in-depth perceptions related to the technology (Koç, 2013; Saban, 2009).

Data Analysis

In the study data were analyzed in both quantitative and qualitative ways. In the quantitative part, frequencies and percentages of demographic information and metaphorical words/phrases were calculated and tabulated in order to express the data. In the qualitative part, content analysis was used. First of all, the metaphors written were written as a list. To create the categories, researchers made inferences to determine the meaning of each word and concept in use. In the Categorization Stage, it was concluded that technology-related metaphors were compared as positive, negative or neutral, in line with the literature (Dönmez-Usta & Ültay, 2015; Dönmez-Usta et al., 2016). After the first author completed all content analysis and coding processes, the metaphors of 25 randomly selected teacher candidates (20%) were coded by the second author to ensure validity and reliability, and the agreement between the authors was found to be 92.50% according to Miles and Huberman's (1994) fix index.

Ethical Note: Research and publication ethics were complied with. Ethical approval was obtained for this research from the Scientific Research Ethics Committee of Çanakkale Onsekiz Mart University Graduate Education Institute (2024-YÖNP-5184).

Findings

In this section, preservice science teachers' metaphorical perceptions related to "technology" concepts will be explained in detail. First, all perceptions are categorized as positive (N=83), negative(N=15), and neutral(N=12). Then, each category is analyzed separately. Each category is divided into codes to bring words/phrases together. Table 2 represents codes and frequencies from positive category.

Table 2. Codes and Frequencies in the Positive Category

Code	Frequency	Word/Phase	Frequency
Need	20	Artery	1
		Oxygen	4
		Vitamin	1
		Water	7
		Food	4
		Eye	1
		Shoe	1
		Weather	1
Developing	19	Life	8
		Child	4
		Brain	5
		Tree	1
		Loop	1
		Human	5
Changing	11	Puzzle	2
		Career	1
		Mind	2
		Starfish	1
		Reincarnation	2
		Plenary worm	1
		Rain	1
		Development	1
Valuable	7	Sea	2
		Universe	1
		Nervous system	2
		Organism	2
Enlightening	6	Light	5
		Sun	1
Source of Information	5	Brain	1
		Book	1
		Library	2
		Information network	1
Facilitating	5	Button	1

		Computer	1
		Tool	1
		Oven	1
		House	1
Guiding	5	Key	1
		Time	2
		Creativity	1
		Queen	1
Giving direction	4	Clock	1
		Infinity	1
		Pole star	1
		Compass	1
Widespreading	1	Skill	1

According to Table 2; positive codes were; need(N=20), developing(N=19), changing(N=11), Valuable(N=7), enlightening(N=6), source of information(N=5), facilitating(N=5), Guiding(N=5), giving direction(N=4), and widespreading(N=1) from the most to the least. In addition, each code includes one or more words/phrases. In Table 3, the most frequently cited example sentence from each code is presented as a sample quote.

Table 3. Sample Quotes from Codes in the Positive Category

Code	Word/Phrase	Sample Quote
Need	Water	We cannot live without it.
Developing	Life	…. is constantly evolving and changing.
Valuable	Organism	There is a wonderfully working mechanism inside.
Changing	Puzzle	…. varies depending on the information inside.
Enlightening	Light	…. brightens our lives
Source of Information	Library	It contains infinite information.
Facilitating	Computer	We can easily access the information we want.
Guiding	Queen	…. helps us in every field.
Giving direction	Pole star	…. gives direction to our lives.
Widespreading	Skill	…. spreads to everyone.

In Table 3, sample quotations from mostly stated words/phrases in codes are given. According to table 3, it can be said that which word or phrase by used by preservice science teachers, the sentence had the positive meaning. Then, the second category for metaphorical perceptions related to technology was neutral(N=12). In this category, preservice science teachers stated both pros and cons related to the technology concept. Table 4 represents codes and frequencies from neutral category.

Table 4. Codes, Words/Phrases, Frequencies and Sample Quotes in the Neutral Category

Code	Frequency	Words/Phrases	Frequency	Sample Quote
Balance	6	Hemostasis	1	If we cannot establish balance, it will cause harm.
		Chocolate	2	Small amount is okay but large amount gives harm.
		Medicine	2	When we use it for health, we benefited; when we use too much, we poisoned.

		Energy	1	It is harmful when used in excess, but provides benefits when used appropriately.
Variability	6	Playdough	1	It can be shaped according to the desired situation.
		Bee	1	It is both sweet as honey and harmful as its needle.
		Knife	1	It is important for what purpose we use it.
		Chameleon	2	…. changes constantly.
		Sky	1	… when it is cloudy it is bad, but when it is sunny, it is beautiful.

When Table 4. Is examined, it is seen that the preservice science teachers' neutral metaphorical perceptions related to technology are divided into balance (N=6) and variability (N=6) codes. Words/phrases in the balance code was hemostasis (N=1), chocolate (N=2), medicine (N=2) and energy (N=1). Words/phrases in the variability code was playdough (N=1), bee (N=1), knife(N=1), chameleon (N=2) and sky (N=1). Sample quotations from each word/phrase was also given in the Table 4. When sample quotations are examined, it can be said that they referred to both positive and negative sides of the technology concept. Finally, preservice science teachers' negative (N=15) metaphorical conceptions related to technology concept was given at Table 5 with codes, frequencies, word/phrase and sample quotations.

Table 5. Codes, Words/Phrases, Frequencies and Sample Quotes in the Negative Category

Code	Frequency	Words/Phrases	Frequency	Sample Quote
Addictive	7	Alcohol	1	… harms people
		King	1	He makes us his slaves and uses us at all times.
		Cigarette	3	It is addictive.
		Addiction	2	We need something higher and more in every time.
Harmful	4	Monster	1	It continues to grow and cause harm.
		Love	1	Its presence is addiction, and its absence is depression.
		Money	1	…. too little will harm, too much will spoil.
		Spider	1	It surrounds us, we cannot escape.
Endless	4	Space	1	It is an endless void.
		Black hole	1	It stucks us and we can't escape
		Bottomless pit	1	…. brings us to the bottom
		School	1	…. endless

According to Table 5, preservice science teachers' negative metaphorical perceptions related to the technology were codes as additive(N=7), harmful(N=4), Endless(N=4). Words and phrases in the addictive code was; alcohol(N=1), king(N=1), cigarette(N=3), addiction(N=2) which were given with sample quotes. The second code in the negative category was harmful with the following words/phrases; monster(N=1), love(N=1), Money(N=1), spider(N=1) which were given with sample quotes. The third and the last code in the negative category was endless with following words/phrases; space(N=1), black hole(N=1), bottomless pin(N=1), and school(N=1) which were given with sample quotes. In short it can be stated that all words/phrases are explained in a negative way when sample quotes were read.

In today's world, technology is used in many disciplines including education. Although technology facilitates and improves effectiveness of learning environments, some of its negative effects are still open to discussion. Therefore, future teachers' perceptions related to technology are important. Accordingly, the aim of this study was to examine preservice science teachers' metaphorical perceptions related to the technology concept. In order to understand their metaphorical perceptions, metaphors were used in this study. Metaphor is a cognitive tool in which people try to understand and/or explain abstract concepts (Saban, 2009). Using metaphors facilitates to the explanation of the the abstract concept desired to be defined properly. According to the metaphorical conceptions obtained from preservice science teachers; technology is perceived positively (N=83) and negatively (N=15) and neutral (N=12). This general finding was consistent with the previous literature (Dönmez-Usta et al., 2016; Korkmaz & Ünsal, 2016). According to the results from both Dönmez-Usta et al., (2016) and Korkmaz and Ünsal (2016) preservice teachers have positive and

negative metaphorical perceptions related to the technology. Since these two studies did not find any significant relationship between metaphorical perception, grade and gender, these variables were not statistically analyzed in this study.

First of all, in this study more than seventy-five percent of the preservice science teachers have positive metaphorical perceptions related to the technology. Similarly, in Dönmez-Usta and colleagues' (2016) study, they found 103 positive perceptions from 118 metaphors. In this study, positive metaphorical conceptions related to the technology concept were associated with useful, developing, changing, need, unlimited, helpful, valuable, source of information, facilitating, enlightening, widespreading and guiding. These codes consisted with the literature which stated found similar codes from their study (Dönmez-Usta et al., 2016; Korkmaz & Ünsal, 2016; Şanal, 2022). Korkmaz and Ünsal (2016) reported that preservice teachers concentrated on importance on technology by stating its developing, changing and facilitating role. These founded codes also showed that technology is an important part of preservice science teachers' lives along with the constantly developing and changing aspects of the technology (Culp et al., 2005; Taylor, 2009). From positive category, most stated words was life(N=8) and water(N=7). By considering these two words it can be claimed that technology is an important as life and a need just like water.

Secondly, fifteen preservice science teachers coded technology is a negative thing. These codes were related to the addictive, harmful and endless sides of the technology. These codes were also consisted with the literature (Balkan-Kiyici, 2018; Batur & Uygun, 2012; Durukan et al., 2016). For example, in Batur & Uygun's (2012) study participants also concentrated on technology that could be addictive. Accordingly, Balkan-Kiyici (2018) also reported that technology can cause harmful effects due to its addictive side especially for students. Therefore, teachers should be careful about using technology. In this study, mostly stated negative word related to the technology was cigarette which is addictive and harmful for human health. Hence, it can be argued that preservice teachers have an important role in using technology in their classrooms (Kalonde & Mousa, 2016). Third and the last category was neutral in which preservice science teachers stated both positive and negative sides of the technology by using same metaphor. Twelve preservice science teachers use neutral metaphorical conceptions. Their quotations were a determinant factor that they seem technology perceived as a neutral. Technological neutrality means that technology is neither positive or negative nor neutral but depends on the situation (Whelchel, 1986). For instance, in this study two preservice science teachers used medicine metaphor by defining technology. Medicine is beneficial if we use it for health purposes, but it can be also toxic if we use a lot. In this sense teachers should use technology for educational purposes (Ertmer, 2005).

Conclusion & Recommendations

In short, it was concluded that technology concept was mostly perceived positively by preservice science teachers, but also perceived it neutrally and negatively. By considering these findings, it can be stated that personal experiences, thoughts, and ideas shape preservice science teachers' technology perception as a positive, neutral or negative. Preservice science teachers' neutral or negative perceptions can be decreased by positive experiences related to the technology. Since technology is necessary in modern science education, preservice science teachers' positive perceptions are essential. Since preservice science teachers' metaphorical perceptions related to the technology was limited in the literature, it is believed that this study will contribute to the literature. By thinking these conclusions into consideration these are recommended for future studies.

- Preservice science teachers are future teachers. Therefore, their perceptions related to technology is needed. This study can be repeated by different preservice teacher education groups.
- Teachers' technology implementation into classroom are essential. Therefore their perceptions related to technology were important. This study can be repeated by inservice teachers from science or other disciplines.
- Technology develops and changes rapidly. Therefore, this study can be repeated in the future with preservice science teachers.

Contributions of the Researchers

All authors contributed to the manuscript equally.

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Conflicts of Interest

The authors have no conflicts of interest to declare.

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