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Views of Preservice Science Teachers on Sustainable Development Awareness

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Fen Bilgisi Öğretmen Adaylarının Sürdürülebilir Kalkınma Bilincine Yönelik Görüşleri

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Abstract

In the study, it was aimed to determine the awareness of 81 pre-service science teachers studying in different classes about sustainable development. Phenomenology design was used to determine the views of science teaching department students about sustainable development. Since the concept of sustainability is related to the field of science and science teachers have a role in providing the students with the achievements related to sustainability in the science program, the study was conducted with the students of the faculty of education science teaching department. A semi-structured interview form was used to collect data. The data collected within the scope of the study were analyzed using content analysis. While analyzing the data, codes were created according to the answers given by each student. Similar codes were categorized taking into account the dimensions of sustainable development, the objectives of the United Nations development program, and the answers given by the students. As a result of the analysis of the data, it was concluded that the students of science teaching department had average knowledge about sustainable development, but they did not have sufficient knowledge about sustainable development. Considering the results, studies can be conducted on the sustainable development awareness of pre-service teachers in different branches. In addition, it is recommended to organize activities and conferences that will positively affect the sustainable development awareness of pre-service teachers.

Article Info

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Fen Bilgisi Öğretmen Adaylarının Sürdürülebilir Kalkınma Bilincine Yönelik Görüşleri

Öz

Çalışmada, farklı sınıflarda öğrenim görmekte olan 81 fen bilgisi öğretmenliği bölümü öğrencisinin sürdürülebilir kalkınma hakkında farkındalıklarının belirlenmesi amaçlanmıştır. Fen bilgisi öğretmenliği bölümü öğrencilerinin sürdürülebilir kalkınma hakkındaki görüşleri belirleneceğinden olgubilim deseni kullanılmıştır. Sürdürülebilirlik kavramının fen alanı ile ilişkili olması ve fen programında sürdürülebilirliğe ilişkin kazanımları öğrencilere kazandırmada fen bilgisi öğretmenlerinin rol alması nedeniyle eğitim fakültesi fen bilgisi öğretmenliği bölümü öğrencileri ile çalışılmıştır. Verilerin toplanması amacıyla yarı yapılandırılmış görüşme formu kullanılmıştır. Çalışma kapsamında toplanan veriler içerik analizi kullanılarak analiz edilmiştir. Veriler analiz edilirken her bir öğrencinin vermiş olduğu cevaplara göre kodlar oluşturulmuştur. Sürdürülebilir kalkınmanın boyutları, Birleşmiş Milletler Kalkınma Programı amaçları ve öğrencilerin verdikleri cevaplar dikkate alınarak benzer kodlar kategorileştirilmiştir. Verilerin analizinin sonucunda fen bilgisi öğretmenliği bölümü öğrencilerinin sürdürülebilir kalkınma hakkında ortalama düzeyde bilgilerinin olduğu ancak sürdürülebilir kalkınma hakkında yeterli bilgiye sahip olmadıkları sonucuna ulaşılmıştır. Ulaşılan sonuçlar doğrultusunda ilgili çalışmanın kapsamı genişletilerek farklı branşlarda öğrenim gören öğretmen adaylarının sürdürülebilir kalkınma farkındalıklarına yönelik nitel çalışma yapılabilir. Öğretmenlik bölümlerinde öğrenim gören öğrencilerin sürdürülebilir kalkınma bilincini olumlu yönde etkileyecek etkinliklerin ve konferansların yapılması önerilmektedir.

Makale Bilgisi

Anahtar Kelimeler:
Sürdürülebilirlik, sürdürülebilir kalkınma, fen bilgisi bölümü öğrencileri

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Geniş Özet

Giriş

Sürdürülebilirlik çevresel, ekonomik ve sosyal açıdan var olan kaynaklarımızı korumak ve gelecek nesillere aktarabilmek olarak tanımlanmaktadır. Artan nüfus yoğunluğu, kaynakların bilinçsizce tüketimi, çarpık kentleşme ve çevreye zarar verecek şekilde sanayileşme sürdürülebilirliği tehlike altına sokmaktadır. Sürdürülebilirliğin sağlanması amacıyla ülkemizde ve dünyada "Sürdürülebilir Kalkınma" başlığı altında çeşitli çalışmalar yapılmaktadır. Sürdürülebilirliğin ülkemizde ve dünyada kesin olarak sonuç vermesi için yapılan çalışmalarla birlikte her bir birey için farkındalık oluşturulması gerekmektedir. Bu farkındalık ise erken dönemde çocuklara sürdürülebilirliğe yönelik sağlam alt yapının oluşturularak eğitim verilmesiyle mümkün olmaktadır. Buna bağlı olarak ülkemiz eğitim programları arasında yer alan fen bilimleri dersi eğitim programında sürdürülebilir kalkınmaya yönelik kazanımlar yer almaktadır. Bu kazanımların öğrencilere kazandırılmasında ise fen bilgisi öğretmenleri etkili olmaktadır. Sonuç olarak fen bilgisi öğretmenlerinin ve fen bilgisi öğretmen adaylarının sürdürülebilir kalkınmaya yönelik bilgi düzeylerinin üst seviyede olması gerekmektedir. Bu sebeple öğretmenliğin ilk ve önemli basamağı olan fen bilgisi öğretmen adaylarının sürdürülebilir kalkınmaya yönelik farkındalıklarının belirlenmesi çalışmanın amacı olmuştur. Çalışmanın başarılı bir şekilde tamamlanmasıyla birlikte fen bilgisi öğretmen adaylarının sürdürülebilir kalkınma farkındalık düzeyleri belirlenecek ve diğer yapılacak olan benzer çalışmalara destek olacaktır.

Yöntem

Fen bilgisi öğretmen adaylarındaki sürdürülebilir kalkınma olgularının ortaya çıkarılması amaçlandığı için nitel araştırma yöntemi olan olgubilim deseni benimsenerek çalışma yürütülmüştür. Çalışma grubu belirlenirken sürdürülebilir kalkınma ile ilgili farkındalıklarının üst düzeyde olduğu düşünülen fen bilgisi öğretmenliği bölümünde farklı sınıf düzeylerinde okumakta olan öğretmen adayları dikkate alındığından ölçüt örneklem kullanılmıştır. Çalışma grubu farklı sınıf düzeyinde öğrenim gören 51 kadın ve 15 erkek olmak üzere toplan 66 fen bilgisi öğretmen adayından oluşmaktadır. Çalışmada, fen bilgisi öğretmen adaylarının görüşlerinin net olarak belirlenmesi ve zengin veri toplanması amacıyla yarı yapılandırılmış görüşme tekniği kullanılmıştır. Görüşme formu ilgili alanyazın taranarak ve fen eğitimi uzmanından görüş alınarak oluşturulmuştur. Toplamda 8 maddelik yarı yapılandırılmış sorudan oluşmaktadır. Yapılan görüşmeler ortalama olarak 10-30 dakika arasında sürmüştür. Görüşmelerden toplanan veriler içerik analizi yöntemiyle analiz edilmiştir. Katılımcılardan toplanan verilere göre kodlar oluşturulmuş ve benzer kodlar birleştirilerek uygun temalar bulunmuştur. Oluşturulan her bir temaya uygun öğretmen adaylarının ifadelerinden en az bir doğrudan alıntıya yer verilmiştir. Ayrıca toplanan veriler uzmanın görüşlerinden faydanılarak analiz edilmiştir.

Bulgular

Bulgular incelendiğinde sürdürülebilirlik kavramına ilişkin yalnızca tanım yapan öğretmen adayının %37'lik yüzdeyi oluşturduğu, yalnızca örnek veren öğretmen adayının %12'lik yüzdeyi oluşturduğu ve örnekle ile birlikte tanım yapan öğretmen adayının ise %42'lik yüzdeyi oluşturduğu görülmüştür. Dördüncü sınıf öğrencileri genellikle sürdürülebilir kalkınma boyutları ile ilgili cevaplar verirken diğer sınıf düzeyindeki öğrenciler sürdürülebilir kalkınma boyutuyla ilgili olmayan cevaplar da vermiştir. Ayrıca her üç boyuttan bahsederek cevap veren öğrenciler ikinci, üçüncü ve dördüncü sınıf öğrencileridir. Sürdürülebilir kalkınmanın amaçlarına yönelik bulgular incelendiğinde öğretmen adaylarının en çok sorumlu üretim ve tüketim (19) kategorisine giren cevaplar verdikleri belirlenmiştir. Sürdürülebilir kalkınmanın dünyaya katkıları ile ilgili öğretmen adaylarının cevapları incelendiğinde en çok sosyal alanda (51) katkısının olduğunu belirttikleri ortaya çıkmıştır. Sürdürülebilir kalkınma ve yenilenebilir enerji kaynakların arasındaki ilişkiye yönelik bulgulara bakıldığında öğretmen adaylarının en çok çevresel (61) ve ekonomik (40) açıdan ilişkilendirdikleri görülmüştür. Bireylerde sürdürülebilir kalkınma bilincinin artırılmasına ilişkin öğretmen adaylarının görüşleri incelendiğinde en çok sözlü anlatım (42) ile bireylerin bilinçlenebileceğini ifade etmişlerdir. Kaynakların tasarruflu kullanımına yönelik bulgular incelendiğinde ise öğretmen adaylarının gereksiz kullanımın azaltılması gerektiğini (37) ve bu konuda farkındalık (34) oluşturulması gerektiğini ifade ettikleri görülmüştür. Sürdürülebilir kalkınma projeleri hakkında bilgi sahibi olan öğretmen adaylarının %42'lik yüzdeye sahip oldukları ortaya çıkmıştır.

Sonuç

Çalışmanın sonuçlarına bakıldığında fen bilgisi öğretmen adaylarının sürdürülebilirlik tanımını kısmen yapabildikleri için sürdürülebilir kalkınma hakkında yeterli bilgiye sahip olmadıkları düşünülmektedir. Çünkü sürdürülebilirlik kavramı sürdürülebilir kalkınmanın çevresel-sosyal-ekonomik boyutlarında ortak bir zemin oluşturmaktadır. Katılımcılar sürdürülebilir kalkınmanın en az bir boyutunu tanımlamışlardır. Sürdürülebilir kalkınma boyutlarının

tanımları sınıf düzeyinde bakıldığında 3. ve 4. sınıf düzeyindeki öğrencilerin daha bütünsel değerlendirdikleri fakat belirgin bir farklılık olmadığı tespit edilmiştir. Sürdürülebilir kalkınma amaçlarına yönelik sonuçlara bakıldığında öğretmen adaylarının bu konuda farklı alanlardan çeşitli örnekler verdikleri sonucuna varılmıştır. Fakat öğretmen adaylarının verdikleri bireysel örnekler incelendiğinde sürdürülebilir kalkınmanın tüm amaçlarını kapsamamıştır. Ayrıca sürdürülebilir kalkınmanın dünyaya katkılarına yönelik öğretmen adayları çoğunlukla çevresel ve sosyal açıdan değerlendirdikleri görülmüştür. Bir diğer sonuca göre fen bilgisi öğretmen adaylarının büyük bir kısmı sürdürülebilir kalkınma ve yenilenebilir enerji arasında çevresel açıdan ilişki olduğunu ifade etmişlerdir. Fen bilgisi öğretmenlerinin, bireylerde sürdürülebilir kalkınma bilincinin nasıl artırılacağına ilişkin görüşleri alınmıştır. Öğretmen adayları bu farkındalığı arttırmak için çeşitli önerilerde bulunsalar da bu farkındalıktan yeterince yararlanamadıklarını belirtmişlerdir. Sürdürülebilir kalkınmanın gerçekleştirilmesindeki adımlardan birisi de kaynakların verimli kullanılmasıdır. Bu nedenle, hizmet öncesi fen bilgisi öğretmenlerinin kaynakların ekonomik kullanımı hakkındaki görüşleri toplanmıştır. Öğrencilerin görüşlerine göre kaynakların ekonomik kullanımının gereksiz kullanımın azaltılması, bireylerin bu konudaki farkındalığının artırılması, geri dönüşüm faaliyetlerinin artırılması gibi çeşitli yollarla sağlanabileceğini belirtmişlerdir. Bu ifadelere dayanarak, öğrencilerin kaynakların tasarruflu olarak nasıl kullanılacağına dair bilgilerinin yeterli olduğu sonucuna varılmıştır. Sürdürülebilir kalkınma projeleri sürdürülebilirliğin sağlanmasında büyük önem taşımaktadır. Bu sebeple sürdürülebilir kalkınma projeleri hakkındaki bilgi düzeyleri ölçülmek istenmiştir. Bu sonuca göre öğretmen adaylarının görüşleri incelendiğinde öğrencilerin çoğu ülkemizde projelerin yürütüldüğünü ve bu projeleri yetersiz bulduklarını belirtmişlerdir.

Introduction

Sustainability means the continuity of a situation without interruption (Büyükyeğen, 2008; Öztürk Demirbaş, 2015). In other words, sustainability can be defined as protecting the resources we have in environmental, economic, and social terms and transferring them to future generations (Ballı, 2019). Rapid population growth, unplanned urbanization, industrialization without worrying about protecting the environment, and the unconscious use of resources related to this jeopardize sustainability. For this reason, studies are carried out to ensure sustainability in our country and in the world regarding sustainability, transferring the resources we have environmentally, economically, and socially to future generations. These studies are generally carried out under the title of Sustainable Development. In the Brundtland Report, sustainable development is stated as "Meeting the needs of today without compromising the ability of future generations to meet their own needs." (Brundtland, 1987). Since the resources in the world are not distributed equally and are limited, large enterprises and non-governmental organizations have tried to find solutions for sustainable development (Akkuş-Dağdeviren, 2019).

While sustainable development is often used by educators, economists, and politicians, it is also used by other professional groups according to their needs (Alkış, 2007; Summers, Corney & Childs, 2004). Regardless of whichever occupational group uses it, sustainable development is examined under environmental, social, and economic headings and they are all associated with each other holistically. In the literature, environmental, social, and economic topics are defined as follows (Borg, Gericke, Höglund & Bergman, 2013; Brundtland, 1987; Erbay & Özden, 2018; Kaypak, 2011; Jegstad & Sinnes, 2015; Öztürk-Demirbaş, 2015; Seydioğulları, 2013; Tıraş, 2012):

Environmental sustainability: It is sustainability that aims to protect biodiversity and ensure the continuity of natural resources, taking into account basic ecological processes.

Social sustainability: It is sustainability that takes into account the strengthening of the identity of the society, the continuity of the society and the continuity of the culture affected by the change, the protection of social values, and the improvement of people's quality of life.

Economic sustainability: It is sustainability-related to ensuring the necessary economic developments for the transfer of natural and cultural resources to future generations.

Since sustainability is getting more important in our age the number of projects aimed at sustainability in Turkey is increasing (Ballı, 2019). 'Covid-19 Response and Resilience', 'Increasing Employability for Syrian Refugees and Turkish Host Communities in the Renewable Energy Sector', 'Health System Strengthening and Support Project', 'I Can Manage My Business', 'Addressing Invasive Alien Species Threats at Key Marine Biodiversity Areas', 'Turkey's engineers girls', 'Applied SME Capability Building Center (Model Factory)', 'Life's Simpler With Internet', 'Employment and Skills Development Project - Component 1', 'Employment and Skills Development Project - Component 2', 'Sustainable Energy Financing Mechanism for Solar Photovoltaic Systems in Forest Villages in Turkey', 'POPs Legacy Elimination and POPs Release Reduction Project','Capacity Development for Sustainable Community Based Tourism', 'Social Cohesion between Syrian and Host Communities through Women's Empowerment Project', 'Integrated Resource Efficiency in Agriculture and Agro-based Industries in the Southeast Anatolia Region Project' are some of the projects carried out in Turkey (United Nations Development Programme Türkiye, 2019). These projects contribute to the achievement of absolute sustainability in our country and the world. In addition, awareness should be created in communities for sustainability to be realized. This awareness can be achieved by establishing the infrastructure for sustainability and providing training for children at an early age (Harman, 2017; Şahin & Dostoğlu, 2015).

In the relevant literature, there are studies in the following areas, awareness of primary education teacher candidates, science education teacher candidates, science teachers, social studies teachers, primary school students, and university students studying at the science and technology center on sustainable development (Andic & Vorkapic, 2017; Çobanoğlu &Türer, 2015; Faiz & Bozdemir Yüzbaşıoğlu, 2019; Selvi, Selvi, Güven Yıldırım & Köklükaya, 2018; Kalsoom, Khanam & Quraishi, 2017; Kavaz & Öztoprak, 2019; Öztürk Demirbaş, 2015; Prabawani, Hanika, Pradhanawati & Budiatmo, 2017; Saka & Şahintürk Uysal,2014); scale development for sustainable development awareness (Atmaca, Kıray & Pehlivan , 2019); primary school teacher candidates' attitudes towards sustainable environment (Başaran Uğur, Bektaş & Güneri, 2019; Çimen & Benzer, 2019; Karademir, Uludağ & Cingi, 2017; Keleş, 2017; Yıldız, 2011); attitudes of forest engineers and primary school teacher candidates towards sustainable environment (Saka & Şahintürk, 2013); determining the sustainable environmental awareness of high school students (Amran, Perkasa, Satriawan, Jasin & Irwansyah, 2019); teachers'and prospective teachers' views on education for sustainable development (Öztürk & Olgan, 2016; Uğraş & Zengin, 2019) and their beliefs (Akça, 2019; Ateş & Gül, 2018; Sağdıç & Şahin, 2016); primary school teacher candidates (Abu-Alruz, Hailat, El-Ceredat & Khasawneh, 2018; Borges, 2019; Kahriman Pamuk, 2019) and United Arab Emirates University students (Al-Naqbi & Alshannag, 2018) determination of sustainable development attitudes; teacher candidates (Er Nas & Şenel Çoruhlu, 2017; Harman,

2017; Montebon, 2018), teachers' (Borg et al., 2013), academicians' (Sinakou, Boeve-de Pauw, Goosens & Van Petegem, 2018) perceptions on the concept of sustainable development; teachers' (Karalar & Kiracı, 2010) and teacher candidates (Ateş, 2018) determination of sustainable consumption behavior; examination of teacher candidates' sustainable development competencies (Soysal, 2017) awareness of university students about sustainable development goals (Zamora-Polo, Sanchez-Martin, Corrales-Serrano & Espejo-Antunez, 2019). When the studies in the literature regarding the subject of the study were examined, it was determined that various studies were carried out under the topic of sustainable development awareness of teacher candidates. Some of these studies aimed to determine the sustainable development awareness of teacher candidates (Faiz & Bozdemir Yüzbaşıoğlu, 2019; Selvi et al., 2018; Öztürk Demirbaş, 2015). The results of the studies differ: it was reached the result that according to the study of Öztürk Demirbaş (2015), it was found that teacher candidates were at an average level, above average in the study of Faiz and Bozdemir Yüzbaşıoğlu (2019), and in the study of Selvi et al., (2018) that teacher candidates' awareness of sustainable development was not at a sufficient level. In other studies, the sustainable development awareness levels of teacher candidates in different countries were compared (Andic & Vorkapic, 2017; Kalsoom et al., 2017). In the study of Kalsoom et al. (2017), when the awareness about sustainable development of teacher candidates in Pakistan and high school students in Sweden were compared, the awareness level of high school students in Sweden was higher. In the study of Andic and Vorkapic (2017), the awareness of Croatian and Slovenian teacher candidates on sustainable development was higher than the awareness of teacher candidates from Bosnia-Herzegovina and Serbia.

Teachers have an important role to play in providing students with sustainability awareness and in developing their awareness. Particularly in the vision of science curriculum it is aimed to raise awareness towards sustainable development subject (National Education Ministry, 2018). For that purpose, objectives towards sustainable development took part in the science curriculum developed by National Education Ministry (2018). And science teachers are very effective in making students gain those objectives. For this reason, science teachers must have adequate knowledge about sustainable development. This knowledge is mostly gained at master's degrees. This knowledge that science teachers gain at undergraduate degree help students to develop their awareness about sustainable development and make contribution to reach sustainable future targets when they begin their teaching profession (Er-Nas & Şenel-Çoruhlu, 2017). In the scope of research problem, it was aimed to determine the awareness of science teaching department students about sustainable development. Thus, the study will determine the sustainable development awareness level of the science teaching department students and will support the studies on sustainable development.

1. What is the knowledge of pre-service science teachers about the environmental dimension of sustainable development?
2. What is the knowledge of pre-service science teachers about the economic dimension of sustainable development?
3. What is the knowledge of pre-service science teachersabout the social dimension of sustainable development?
4. How does the awareness of pre-service science teachersat different year levels about sustainable development change?

Method

The study was carried out by adopting the phenomenology pattern from qualitative research methods. The phenomenology design aims to determine how individuals express their experiences about an event or phenomenon and what kind of awareness they create (Çepni, 2021; Patton, 2014). In phenomenology research, it is aimed to reveal how an individual perceives or interprets a phenomenon (Seggie & Bayyurt, 2015; Yeşilyurt & Erol, 2019). In other words, making sense of the facts may differ according to the experience, life, or thoughts of each individual. For this reason, under the theme of sustainable development, the study was carried out by adopting phenomenology research, as it was aimed to reveal what the students of the science teaching department know and their perceptions about this subject, taking into account their experiences. Also, ethical approval was obtained for this research from the Science and Engineering Ethics Committee of Suleyman Demirel University (Date: 04.03.2020, Number: 87432956/050.99/38433).

Study Group

The study group of the study is composed of students who study at each year level in the science teaching department of different education faculties, using criterion sampling, which is one of the purposeful sampling methods. The criterion chosen for purposeful sampling guides revealing a subject or phenomenon aimed at the research with its details and providing a variety of data related to the subject of the study (Merriam, 2018). In the determination of this study group, the criterion sampling was preferred because the science teaching department students who were thought

to have a high level of awareness about sustainable development were preferred. The research was conducted voluntarily with 81 students studying in Artvin Çoruh, Atatürk, Dumlupınar, Süleyman Demirel and Trabzon Universities in science teaching at the 1st, 2nd, 3rd and 4th years. In accordance with the research ethics, it was coded as $S1_{1,2...}$, $S2_{1,2...}$, $S3_{1,2...}$, $S4_{1,2...}$taking into account the class levels instead of the names of the students in the study group.S1, S2, S3, S4 represents the year levels of the students.

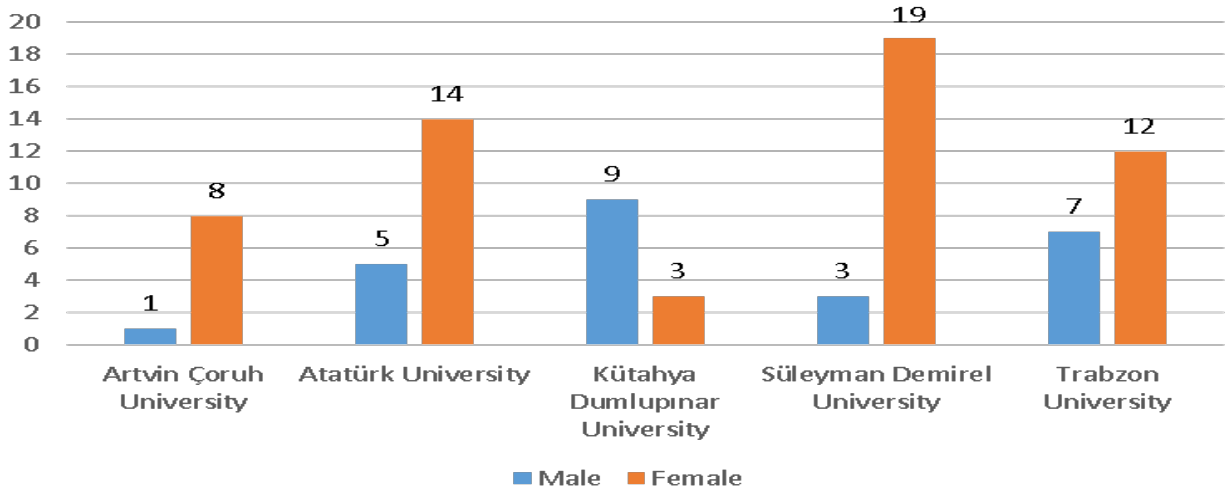

Figure 1. Distribution of the Number of Students in the Study Group

Data Collection and Data Collection Tool

Data collection is defined as the state of collecting and organizing information in line with the problem situation identified in the research (Creswell, 2018). In the study, to determine the views of pre-service science teachersmore clearly and to obtain richer data, a semi-structured interview technique was used. After the interview form was prepared, views were taken from an expert who has studies on sustainable development and a science education expert who will be included in the study, and the order of the items in the interview form was ordered from general to specific. In addition, probing questions were added to ensure that the data to be obtained were richer, and an interview question was changed because it was not understood sufficiently. The following (Table 1) includes the probe questions added to the interview questions.

Table 1. Probes Added to the Interview Form

Interview Question	Added Probe Questions
Is there a relationship between renewable energy sources and sustainable development?	If so, what kind of relationship is there? Economic, environmental, etc.
What kind of a path can be followed for the economical use of resources?	Water, electricity, heat, etc.
Do you think there is a project/study of sustainable development in our country?	What are these projects/studies? Do you find the studies done sufficient? Why is that?

Interviews with science teaching department students completed in three months and each interview lasted for 30 minutes. Interviews with the participants were conducted face to face. Interviews were recorded by the researcher with the permission of the participant.

Data Analysis

In this study, the data collected from the participants were analyzed by content analysis method. The main purpose of content analysis is to obtain the concepts that can describe the data obtained and the relationships between these concepts (Patton, 2014). In the content analysis method, the collected data are analyzed sequentially (coding the data, finding themes, organizing codes and themes, defining and interpreting the findings) (Berg & Lune, 2015). According to the data collected from the participants, 13 categories were created by considering a total of 107 codes and similar codes. 13 categories in the study are created by linking the definitions, dimensions, and purposes of sustainable development in the literature. Finally, at least one direct quotation from students' expressions related to each category was included, and the number of students for the relevant category was shown with a table and/or graphic. In addition, the data collected by taking into account the questions in the interview form were analyzed by the researchers. The

data analyzed by the researchers were examined by an expert and the inter-coder consensus was calculated as .80. Data analysis is considered reliable if the consensus between coders is at least 80% (Patton, 2002). Therefore, the data analysis performed in the study is considered to be reliable.

Results

In the study, answers to the research problem and sub-problems were sought with the questions in the semi-structured interview form. Descriptions of the questions answered by the students are included in this section. In some of the tables and graphs in this section, the answers given were added to each code or category because a person said more than one code or category. For this reason, the total frequency is higher than the actual number of students.

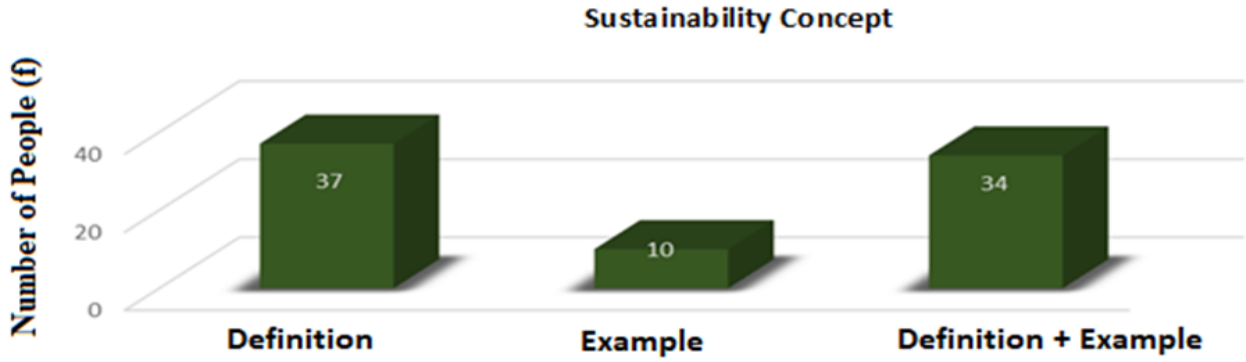

Figure 2. Student views about the concept of sustainability

The students of the science teaching department were asked the questions 'According to you what is sustainability?' and 'How do you define it?'. Considering the answers given by the students, three codes were created as 'definition', 'example', and 'definition + example'. These codes were grouped under the concept of sustainability. The definition code was created considering that those who express the definition of the concept of sustainability as 'continuing' in general gave the definition correctly. An example code was created for those who made a definition by explaining the concept of sustainability through examples. A definition and example code was created for students who both made definitions and gave examples. Created codes and frequency numbers are given in Figure 2. Accordingly, the number of students who only made a definition regarding the concept of sustainability was 37 (46%), the number of students who made a definition by giving examples was 10 (12%), and the number of students who made a definition and gave examples was 34 (42%) (Figure 2). The answers falling into the codes mentioned above are exemplified below, taking into account the answers of students from each year level.

Answers given for the definition code:

$S1_{12}$: "… Trying things that go on and progress constantly."

$S2_{1}$: "Doing and repeating something continuously."

$S3_{24}$: "First of all, the word continuity comes to life in my mind… the word comes to mind in the way of not being exhausted or circulating."

$S4_{2}$: "I think it is like not finishing, continuing, making something continuous."

Answers given for the example code:

$S1_{15}$: "I have heard about it that it has to be sustainable in order to leave a cleaner environment for future generations."

$S2_{13}$: "In the future, the hardware things that are necessary for our current thoughts to continue their validity in the future."

$S3_{7}$: "… We try to be sensitive to the environment, we try to recycle the wastes, we try to make it sustainable."

$S4_{17}$: "Well we can say everything about environmental protection. So this could be garbage, it could be energies, it could be water pollution. I can give examples of these. "

Answers given for the definition + example code:

$S1_{13}$: "It means endless, inexhaustible, continuing. For example, solar energy or wind energy, so long as the universe is alive, we can use them. I think this is sustainable. "

$S2_{12}$: "… The continuation of an event like this… For example, science is something that can be renewed and continues continuously…"

$S3_{10}$: "Sustainability is a continuation. That is, the energy is taken from the beginning or the continuation of anything in the same way. "

$S4_4$: "It's like something going on. In other words, the elimination of a problem and the continuous solution. "

Sustainable development is examined under three headings as environmental, social, and economic (Brundtland, 1987). It has been determined that some of the answers given by the students are related to the dimensions of sustainable development and some of them are not related to the dimensions of sustainable development. For this reason, categorization has been made taking into account the sustainable development dimensions. Considering this categorization, Table 2 has been created.

Table 2. Student views on the definition of sustainable development

	Sustainable Development Dimensions	**1st year (f)**	**2nd year (f)**	**3rd year (f)**	**4th year (f)**	**Student Views**
Respondents Related to Dimensions of Sustainable Development	Environmental	1	1	2	1	$S3_{14}$: "*I think it can be to reduce the damage to the environment, not to destroy something in the environment, but to ensure their continuity.*"
	Social	2	-	3	1	$S3_1$: *"It can be in the political field, … in any field. It happens in education, it can be in health."*
	Economic	1	1	3	2	$S3_{24}$: *"By constantly updating such things, I can say trying to stay one step ahead of the technology or sales market areas we are in or not to fall back."*
	Socio-economic	5	3	2	5	$S1_2$: *"For example, society can be developed as an intellectual structure or, I do not know, various technological news or industry can be developed in this direction. Sustainable development is to constantly develop these behaviors. "*
	Socio-Environmental	-	-	1	3	$S4_3$: *"People need to be able to pass on their natural needs to the new generations or other generations … it should not be consumed differently, that is, it should not be consumed unnecessarily and it should be consumed correctly to the new generation for humanity and it is within a certain plan. This is called sustainable development. "*
	Economic-Environmental	3	-	3	4	$S4_{21}$: *"In other words, it is like going to the economy from the energy it reminds me … Let's turn off the lights, let's not run wasted water"*
	Environmental-Social-Economic	4	5	6	7	$S4_{14}$: *"… let's suppose, we produce airplanes… we continue this according to their characteristics, the needs of the age of the day. For example, we adapt it to ourselves as an economy… As a knowledge, as an economy, as technology… So for example, they produce renewable energy or continue it… "*
Respondents Not Related to Sustainable Development Dimensions	Make something better	1	-	2	-	$S3_2$: *"Making it better, more beautiful, more livable."*
	Solving and applying the problems encountered	-	-	1	-	$S3_3$: *"… For example, I found a way to solve the problem, but I have to apply this way of solving…."*
	Ensuring the continuity of development	2	-	-	-	$S1_{12}$: *"Well, the orderly realization of something that can be maintained regularly is called development."*
	Increasing the number of studies on sustainable development of countries	-	-	1	-	$S3_{12}$: *"It may be like increasing these sustainable methods by the state."*
	Country's development	-	1	-	-	$S2_6$: *"That is how I think of sustainability, that is, the development of the country. "*
	Couldn't define it	2	2	-	-	$S2_9$: *"Sustainable development… Well, I don't know."*

The question of 'How would you define sustainable development?' was directed to the science students. Table 2 was created by considering the answers given and the dimensions of sustainable development. Considering the respondents related to the dimensions of sustainable development, seven codes: 'environmental', 'social', 'economic', 'socio-economic', 'socio-environmental', 'economic-environmental' and 'environmental-social-economic' has been created. For those who do not respond concerning the dimensions of sustainable development, taking into account their answers, six codes were created, including 'to make something better', 'to solve and implement the problems encountered', 'to ensure the continuity of development', 'to increase the number of studies on sustainable development of countries' and 'the development of the country'. When the respondents' category related to the dimensions of sustainable development is examined vertically in the table, the 1st year students mostly describe the socio-economic dimension (5), while the 2nd year students do not make any definitions for the socio-environmental dimension; the second-year students are the most environmental-social-economic (5) dimension, they did not define the social, socio-environmental and economic-environmental dimensions in their answers; Looking at the 3rd year students, they mostly defined in the environmental-social-economic (6) dimensions, and at least in the socio-environmental (1) dimension; while the 4th year students mostly defined in the environmental-social-economic (7) dimension, the least social (1) and environmental (1) dimensions. While 4th year students generally gave answers about the sustainable development dimension, the students at the other year level also gave answers that were not related to the sustainable development dimensions. Considering the answers given by the students in this category: Cannot define sustainable development (4), improve something (3); ensuring the continuity of development (2); the development of the country (1); solving and implementing the problems encountered (1); countries to increase the number of studies on sustainable development (1) codes have been created.

Table 3. Student views on the goals of sustainable development

Sustainable Development Goals	f	Student Views
Responsible Production and Consumption	19	$S4_{17}$"… *Consumption is too high, we also have to produce. Raw materials can be reduced gradually… it can be aimed to recycle the materials we can use. "*
Life below water ve Life on land	15	$S1_{15}$: *"… some people earn their living from the sea and land. Sustainable development aims to ensure the biodiversity on land and sea.."*
Quality Education	13	$S2_{10}$: *"… It could be in the field of education. For example, it can be ensured that all of our schools, including the village schools, are equal to the schools in Istanbul ... Similarly, all technical high schools and vocational high schools can be at the same level of student requirements from the same science high school. "*
Decent Work and Economic Growth	13	$S4_{22}$: *"… To increase the economy of the country. To increase the productivity of the country, let it be from its employees … "*
Health and Quality Life	10	$S1_{17}$: *"For the society and individuals to live in a more peaceful, healthy and safe life …"*
Industry, Innovation, and Infrastructure	9	$S3_{16}$: "*… It could be the progress of technological advances."*
Climate Action	6	$S3_{19}$: *"… The factors affecting carbon emissions, acid rain or other environmental pollution in the atmosphere can be minimized."*
Reducing Inequalities	5	$S1_{19}$: *" … the country's economy is now in favor of the rich. Those who are not in a good financial situation, do not have much opportunity to eat whatever they want, buy anything from outside. So there is a disorder in terms of equality. I think this can be fixed."*
Zero hunger	4	$S3_{2}$: *"…Maybe dozens of people die of hunger a day. To make this situation better."*
Affordable and clean energy	4	$S3_{12}$: *"…they are solar energy systems, wind roses …to produce energy with different systems and ensure the continuity of this energy.."*
Gender equality	3	$S2_{8}$: *"…There may be gender, inequality in some jobs may be women or men discrimination. Development is taking place to ensure this equality."*
Partnerships for Goals	3	$S4_{12}$: *"… After all, every country is trying to improve. I think that if each country completes it for its development purpose and acts together for a common purpose, our world can progress."*
Clean Water and Sanitation	2	$S4_{2}$: *"…thirst, doing this kind of work to quench these things."*
Peace, Justice and Strong Institutions	2	$S2_{8}$: *"…to ensure peace in terms of country."*
Sustainable Cities and Communities	1	$S2_{1}$: *"…Some things need to be faster to improve the quality of life in transportation."*
No Poverty	1	$S2_{7}$: *"…so this is poverty."*
No information	2	$S1_{8}$: *"…it reminds me of nothing …"*

According to the United Nations Development Programme, sustainable development consists of 17 goals (United Nations Development Programme Turkey [UNDP], 2019). In order to determine the knowledge of pre-service science teachers about these purposes, the question 'What are the aims/objectives of sustainable development' was asked. Table 3 was created taking into account UNDP goals and student responses. The purposes of 'Land Life' and 'Life below Water', which are included in these purposes, are combined because the answers given by the students generally include these two. Considering the codings based on the answers given by the students, it has been determined that they are in parallel with the sustainable development goals. For this reason, the codes created are evaluated under sustainable development goals. In this direction, 17 codes were created. These codes are included in the category of "sustainable development goals". The answers given by the students are placed in the most appropriate code. In the table, they mostly mentioned responsible production and consumption (19), which includes topics such as 'economical use of resources', 'recycling', 'transferring resources to future generations' among the sustainable development goals. Sustainable cities and societies (1), including issues such as 'transportation, urbanization without harming the environment and creating public green spaces', gave an example about the end of poverty (1). Two students do not know about sustainable development goals.

Table 4. Student views on the contribution of sustainable development to the world

	Contribution to the World	f	Views
Environmental	Clean and livable nature	15	$S1_6$: *"... It could be environmental cleaning. Environmental pollution, for example, if a social project is designed, it will benefit it that way. "*
	Reducing climate-related problems	7	$S4_{11}$:*"... It could be environmental cleaning. Environmental pollution, for example, if a social project is designed, it will benefit it that way. "*
	Increasing sustainable energy use	3	$S3_{11}$: *"Their contribution to the world is more to the raw material... What is more continuous rather than oil, for example, maybe converting the energy of motion from rivers to electricity. These can be. These are the benefits."*
	Conservation of biodiversity	2	$S3_{14}$: *"...there are animals which become extinct. I think these can be reduced. People can be made conscious of animals. "*
	Protection of the environment by carrying out projects in the field of environment	1	$S3_{24}$: *"If we can produce 10 notebooks from a tree, thanks to sustainable development, 20 notebooks can be produced from a tree if something new is found. This can give us a benefit to our environment through tree protection and less tree cutting."*
Economic	Economic growth and development	15	$S1_5$: *"I think it can benefit the economy of the state as well as the economy of the person, right up to the wider economy."*
	Increase domestic production	4	$S4_{13}$: *"...The support given to agricultural workers and farmers in our country can be increased. You know, we can get rid of external addiction."*
	Industrialization	1	$S1_2$: *"...Allows us to reach much more advanced levels in the industry."*
	Economic globalization	1	$S4_{14}$: *"So here if I meet all the needs of the advanced age if I brought something to maintain and carry on world markets as Turkey, I do. The whole world benefits ..."*
Social	Conscious societies	11	$S2_5$: *"... I would like to know some studies that are newly developing on my own. Both my culture will expand, I will have the knowledge and our cultural level will increase as a country. "*
	Increasing the quality of education	10	$S3_5$: *"...We can improve once in education. In this direction, primary school should start not only in the university but also in primary school... If we want our country to live comfortably, we should continue sustainable development."*
	Bringing up educated individuals	9	$S3_{15}$: *"Conscious generations and societies can be realized in education."*
	Reducing hunger and poverty	4	$S4_{20}$: *"... There are hunger and poverty in our country too. Here we will prevent them."*
	Healthy lifestyle	4	$S4_5$: *"... It can be healthy in every way. For example, if a person is healthy, he can do anything."*
	Health sector improvement	3	$S1_7$: *"Think of a disease, you are going over it and I think this is the development and you benefit people, so you can prevent a disease."*
	Social equality	3	$S1_9$: *"...in my opinion social proximity of people"*
	Increasing employment	2	$S3_6$: *"...nobody will suffer unemployment and economic hardship."*
	Work time reduction at work	1	$S2_2$: *"You know, let's say you work 10 hours, maybe you work five hours, maybe you have a better time with your family."*
	Solving social problems	1	$S3_3$: *"For example, the problems existing in society disturb people... When we find its solution, people can act more easily. We can be more relaxed psychologically".*
	Communication skills development	1	$S1_{17}$: *"Everyone will be able to understand things better. Empathize with the other person ... By empathizing, he/she can talk to him/her more properly."*
	Increasing entrepreneurial skills in individuals	1	$S4_{22}$: *"...For example, if I give an example from entrepreneurship, students can be more entrepreneurial and they can design more entrepreneurial*

			products…"
	Cultural-artistic developments	1	$S3_{15}$: *"…To create a new world by associating it with different traditions and cultures politically and culturally."*
Economic-Social- Environmental	Improving life standards	12	$S3_{21}$: *"Everyone should reach the opportunities they want easily until they keep from the peasant part of the society and live in the city and sustainable development should be done within this."*
	Technological developments	10	$S4_6$: *"…we can develop more in terms of science."*
	Developed countries	7	$S3_{17}$: *"…sustainable development is greater in developed states. By providing this, we are currently a developing country. We can reach advanced levels in all conditions."*
	Transferring resources to future generations	7	$S4_{10}$: *"The water needs of our children will be met. Because if it goes like this, we may have certain problems before us, such as thirst. If we can eliminate these problems, I think it will be very beneficial for both us and future generations. "*
	Increase in military power	2	$S1_{20}$: *"…if it is in a military sense our army will grow stronger,. We can defend ourselves …"*
	Elimination of political problems	1	$S3_1$: *"Maybe we can do something right that we did wrong. This could be as a political decision."*
	Prevention of colonial activities	1	$S4_7$: *"There may be those who reach out to us. For example, there may be those who try to develop from our country. If we cannot develop the country ourselves, there may be countries that can benefit from our land and develop their own countries.."*
	Ensuring peace	1	$S3_8$: *"Beneficial to the whole country, at least we bring peace to the whole world."*
	Establishing diplomatic relations	1	$S2_6$: *"So the relationship between states should be good …"*
	No idea	5	$S1_{15}$: *"Let's pass this."*

In order to ask the students how sustainable development contributes to the world and what kind of benefits it has, the question 'What are the contributions of sustainable development to the world' was directed. Table 4 was created accordingly.

When Table 4 is examined, considering the dimensions of sustainable development and the answers given by the students, four categories as 'environmental', 'economic', 'social' and 'economic-social-environmental' and 31 codes were created. The answers given by the students were placed in the most appropriate sub-category. When the answers given are examined, they think that sustainable development contributes to the world in descending order in social (51) issues, economic-social-environmental (43) issues, environmental (28) issues, and economic (21) issues. Five students do not know about this subject.

Table 5. Views on the state of the relationship between sustainable development and renewable energy.

Relationship status	Renewable Energy and Sustainable Development Relationship	f	Views
Has	Environmentally friendly	61	$S3_8$: *"For example, we obtain our energy from solar panels and wind roses from them. Those obtained from these do not harm nature."*
	Economy	40	$S1_3$: *"…we can generate electricity through this resource and provide its electricity. It helps economically. For example, it can be much more costly to bring electricity from many other places."*
	Sustainable energy	33	$S1_{17}$: *"…having more solar panels, for example, our consumption… Our consumption is already too much, but it also positively affects it. You know, solar panels have a positive effect because the energy from the sun is constantly being renewed."*
	Energy	27	$S2_{10}$: *"Since we need energy, we can use wind energy and solar energy to the fullest. In other words, we do not need oil economically. We don't have any oil reserves. Our dependence on foreign countries decreases."*
	Nature destruction	7	$S3_{24}$: *"…let me start with hydroelectric power plants. The abundance of hydroelectric power plants harms nature on the one hand.."*
	Cost	11	$S3_{21}$: *"…now we are developing but we are getting energy at a high cost."*
	Health	3	$S2_2$: *"…could be better for human health …"*
	Technology	2	$S2_3$: *"…For example, more technological tools can be made using solar energy."*
	Decrease in Poverty rate	1	$S1_8$: *"…as long as there is a renewal, I think poverty will decrease somewhat."*
	Creation of new business areas	1	$S1_4$: *"…I thought like getting job employment."*
	Touristic trips	1	$S4_{20}$: *"…can even be used for touristic purposes…"*

Hasn't	Sustainable development is a plan	1	$S3_{15}$: *"So I don't think so. Because of renewable energy sources… So it is a development plan, but it can be in different sources."*
	It has no relationship	1	$S1_6$: *"No, I couldn't establish a relationship right now."*

In order to measure students' knowledge about the relationship between sustainable development and renewable energy, the questions 'Is there a relationship between renewable energy sources and sustainable development', 'If so, what kind of a relationship is there' questions were directed. According to the answers given by the students, two categories as 'has' and 'hasn't' and 13 codes were created. The created code, category, and students' views are given in Table 5. The economy code includes topics such as 'savings, economic empowerment'; issues such as environmentally friendly code 'environmental pollution, global warming'; the energy code includes issues such as 'energy needs, foreign-dependency in energy, clean energy, development in the field of energy, energy efficiency'; the cost code includes issues such as 'high cost, low cost'. Most of the students think that there is a relationship between sustainable development and renewable energy. Students mostly evaluated the relationship between sustainable development and renewable energy as 'sustainable energy' (33). The least relation between them is 'decrease in poverty rate' (1), 'creating new sources of income' (1), 'new technological products' (1), 'creation of new business areas' (1), 'ensuring technological developments' (1).), 'energy consumption awareness' (1) and 'touristic trips' (1). Two students think that there is no relationship between sustainable development and renewable energy sources.

Table 6. Views on raising awareness of sustainable development in individuals

Sustainable Development Awareness	f	Views
Verbal expression types	42	$S3_6$: *"…conferences presentations seminars these can be done …"*
Education- Teaching	36	$S2_1$: *"…from primary school on, students can also be educated about this issue and there can be awareness-raising.…"*
Project / Study	28	$S2_8$: *"…there may be projects. These projects can be promotions…. For example, this can be planting trees with TEMA or it can be like it.."*
Media organs	18	$S4_8$: *"…it reaches through the media mostly from televisions… I think it will be announced very easily via social media as everyone uses it actively."*
Poster /Brochure /Billboard/ Slogan	15	$S1_9$: *"…brochure distribution. May contain informative articles about billboards."*
Social organization /Institution / Club	7	$S3_{11}$: *"…social clubs should be established. I mean by social clubs, I suppose Kızılay in schools like Green Crescent club …"*
Survey / Interview / Interview	7	$S1_{16}$: *"There may be polls. There may be individual interviews."*
Concrete Examples	6	$S3_{18}$: *"…The negativities of the environment can be shown to individuals. So we can minimize them."*
Incentives	6	$S4_2$: *"…For example, the state is helping those who invest in agriculture to those who establish factories… For example, when you have solar panels built, the state pays some of it… I think if we support them economically with this kind of aid, people can turn to it."*
Sightseeing tours	6	$S2_1$: *"…some awareness can be achieved by taking students to these places by organizing trips."*
Parent Education	5	$S3_{19}$: *"Families should be educated for this. So something that starts from childhood can be like parenting lessons."*
Short film / Documentary / Theater / Cinema	4	$S4_5$: *"…Because I love theater, I make shows for them or make short films. What will we be in 30 years from now? the situation of animals… they can be more aware when they see from the point of human"*
Sense of wonder	4	$S1_2$: *"…generating electricity from solar energy or other things… These attract people's attention more. They are naturally curious and want to learn. There would be more people developing on this."*
Collective walks	2	$S4_1$: *"So when mass walking is done it is always better when the public becomes conscious."*
Fair / Cultural Center	1	$S1_{19}$: *"It is a fair… Not only knowledgeable people but also everybody passing through the streets should always listen to everyone to explain openly to the public in cultural centers."*
Teamwork	1	$S1_{16}$: *"I would like to work in groups with them. I would instill sustainable development in them."*
Slide / Video	1	$S4_{16}$: *"…Even in an hour, students can be shown a slide that can be instilled, or watch a video."*
No idea	1	$S1_{11}$: *"I have no idea, honestly."*

The students of the science department were asked the questions 'What can be done to increase the awareness of sustainable development in individuals and how can it be followed?' The "Sustainable Development Awareness" category was created with the codes in Table 6. Table 6 was created by considering the answers/suggestions given by the students in this direction. In Table 6, science education students' verbal expression types' (42), 'education and training' (36), 'project / study' (28), 'media organs' (18),' poster / brochure / advertisement board / slogan '(15),' social organization / institution / club '(7),' survey / interview / interview '(7),' concrete examples' (6), 'incentives' (6),' sightseeing tours' (6), 'parent education' (5), 'short film / documentary / theater / cinema' (4), 'curiosity' (4), 'mass walks' (2), 'fair / cultural center' (1), 'group work' (1), 'slide / video' (1) to raise awareness of sustainable development should be used. One person stated that he has no idea about this. They stated that verbal expressions such as 'conference, seminar, forum, panel, debate' should be used in order to increase the awareness of sustainable development in individuals, and at the same time, they said that 'education' and 'parent education' could be effective

in increasing this awareness. They stated that media tools such as ‘television, social media, radio, newspaper, magazine, internet’ should be used in raising development awareness. While emphasizing the need for 'project/study' and 'incentives' for the application in raising this awareness, some of the students stated that 'Poster / Brochure / Billboard / Slogan', 'Short Film / Documentary / Theater / Cinema', 'Slide / Video' they think that with the help of visual tools/materials such as sustainable development awareness can be increased. They also stated that they would provide support to increase awareness of sustainable development in individuals through ‘Survey / Interview / Interview’, ‘concrete examples’, ‘sightseeing tours’, ‘sense of curiosity’, ‘collective walks’, ‘group work’.

Table 7. Views on the economical use of resources

Conservative Use of Resources	f	Views
Unnecessary use	37	$S2_7$: *“As a practice, more attention should be paid to water. Electrical energy should not be used unnecessarily.”*
Awareness	34	$S1_{12}$: *“…Public awareness should be raised not only through individuals but also through society. For example, who wants to save first. He puts his ideas forward.”*
Recycling	21	$S4_{10}$: *“…I think the most basic solution to the economical use of resources is recycling. If recycling occurs, we will use our resources more efficiently.”*
Economical use products	15	$S3_{19}$: *“It may be the use of light bulbs that burn less like fluorescent… goods, furniture that consume less electricity… I'm talking about white goods. A class, A-plus, these goods should be used to save money..”*
Renewable energy sources	12	$S3_{16}$: *“For example, solar energies can be increased. As a result, natural gas also heats the water, but it can be connected to it on sunny days… natural gas can also be energy. Apart from that, wind panels can be made.”*
Mass media	11	$S2_{13}$: *“For this, it is necessary to have lots of advertisements on TV and to organize presentations and symposiums at school. ”*
Plan/program in the use of resources	10	$S3_{22}$: *“…according to the number of individuals in our own home, there should be a certain period of user quota. For example, there should be a quota to use electricity and it should not be exceeded.”*
Heat insulation	7	$S4_{12}$: *“…Heat insulation should be made in new buildings. Thanks to thermal insulation, natural gas can be used less.”*
Sanction	1	$S2_1$: *“…I think it can be in the form of certain sanctions. Garbage was charged and reduced by 50%, for example, to reduce the use of plastic.”*
Supervision	1	$S3_{19}$: *“…Büyük Menderes is now in a very bad condition. This is why water resources are used badly. This may be the inspection of these, the construction of the factories according to a more humane condition.”*
Plan/Program	1	$S1_8$: *“Pre-program can be made, so it is not wasted. So enough is enough, everything can be saved from something.”*

The students of the science teaching department were asked the question ‘What kind of a way can be followed for the economical use of resources’. In this direction, Table 7 was created, which includes the codes created according to the answers given by the students, the frequency numbers, and the student views. The “Conservative Use of Resources” category was created with the codes in Table 7.

In Table 7, considering the answers given by the science teaching department students for the economical use of resources, the consciousness of using economically (37), awareness' (34), 'recycling' (21), 'economical use products' (15), 'renewable energy resources' (12), mass media' (11), 'plan/program in resource use' (10), 'heat insulation' (7), 'sanction' (1), 'supervision' (1), they think that it can be increased in such ways. In order to increase the awareness of using resources economically, the students stated that resources such as electricity/water/heat should be turned off and used carefully, unless they are used, to reduce unnecessary use; choosing ways to raise awareness, such as projects/events, posters/slogans, warning signs, training, concrete examples, and conference/presentation; some of them emphasized that mass media such as television, internet, radio, and newspapers should be used. Use of recycling bins to save resources and increase efforts to recycle water; using photocell taps/lamps, electrical household appliances from energy-saving products; use of renewable energy sources such as solar panels and wind turbines; limiting resources such as water/electricity/heat within the plan/program; they stated that in order to control the energy use of enterprises and to impose sanctions in case of wasteful use and to use the resources that provide the heating need economically, internal and external insulation should be applied to the buildings.

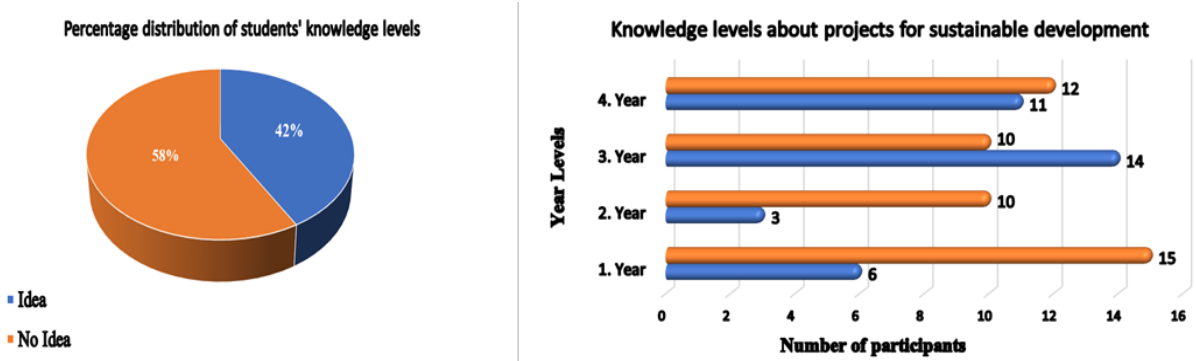

Figure 3. Percentage distribution of students' knowledge levels about projects for sustainable development and the number of participants

In order to determine the awareness of the students about the studies or projects about sustainable development, the questions 'Do you think that projects/studies are carried out for sustainable development in our country', 'What are these studies/projects', 'Do you find the work done sufficient' questions were asked. In line with the answers given by the students regarding sustainable development projects, two categories were created as 'idea' and 'no idea'. Created categories, distribution of student percentage placed in categories, number of participants, and year levels are given in Figure 3. It is acknowledged that students who talked about the content of any project related to sustainable development knew this subject. It is acknowledged that the students who did not give any project example although they said that the projects were carried out, did not have any knowledge about this subject. Figure 3 was created by taking into account the percentage distribution and year levels of the students' knowledge of the projects carried out on this subject. While there are 34 (42%) students in total who have knowledge about sustainable development projects, 47 (58%) students do not have any information about this subject. When the students who have information about the projects are examined at the classroom level, 28% of the 1st year students; 23% of the 2nd year students; 58% of 3rd year students; It was observed that 47% of the 4th year students knew this subject.

Conclusion and Recommendations

Since sustainable development is a concept that includes many fields with environmental, social, and economic issues and is also of great importance for the field of science, the students of the science teaching department should have sufficient knowledge on this subject. In order to determine the sustainable development awareness of the students, it is necessary to measure their knowledge about the concept of sustainability. For this reason, students' views on the concept of sustainability were determined. While 47 of the students in the study group gave only the definition of sustainability or just an example, 34 students gave concrete examples with the definition. It is determined that the results of this study show parallelism with the results of the similar studies (Karakaya-Cırıt, 2017; Kavaz & Öztoprak, 2019) in the literature. It is considered that pre-service science teachers do not have adequate knowledge about sustainable development as their definitions of sustainability are only partly. Because, sustainability concept states as a common ground at environmental-social-economical dimensions of sustainable development (Presidency of the Republic of Turkey Strategy and Budget Presidency, 2016). In other words, there is an important relationship between the sustainability concept and sustainable development. For this reason, it is being thought that to increase pre-service teachers' sustainable development awareness, firstly they have prior knowledge about sustainability.

According to the results of the findings related to the definition of sustainable development, 69 (85%) of the participants defined at least one dimension of sustainable development. Five (6.17%) students regarding the environmental dimension of sustainable development; 6 (7.4%) students related to the social dimension; 7 (8.64%) students related to the economic dimension; 15 (18.51%) students related to the socio-economic dimension; 4 (4.93%) students related to the socio-environmental dimension; 10 (12.34%) students related to the economic-environmental dimension; It was concluded that 22 (27.16%) students knew the environmental-social-economic dimension. Besides, 8 (9.87%) students made definitions not related to the dimensions of sustainable development. It was observed that the number of students who did not know the definition of sustainable development was 4 (4.93%). According to the results, participants linked the definition of sustainable development with socio-environmental dimension at the lowest point. But according to the result of Öztürk & Demirbaş (2015)'s study, pre-service teachers linked the definition of sustainable development with environmental-economical dimension at the lowest point. The difference between the results could arise from the differences of the curriculums of the education foundations participants attend or their evaluation of sustainable development with its different dimensions.

When we analyze student evaluations towards sustainable development dimensions in terms of class level, it is determined that the participants in 3rd and 4th years evaluate more holistically but there is no distinct difference. Since sustainable development is a comprehensive concept that concerns almost every field, students have problems while making definitions for this concept (Er Nas & Şenel Çoruhlu,2017). Also, it is emphasized in the literature that teacher candidates' awareness of sustainable development is insufficient, they cannot evaluate it holistically, and training for sustainable development should be taken (Borg et al., 2013; Er Nas & Şenel Çoruhlu, 2017; Harman, 2017; Öztürk Demirbaş, 2015; Uğraş & Zengin, 2019). As can be seen from the above results, it was concluded that the students of the science teaching department could not evaluate sustainable development as a whole and their awareness was insufficient. The results of this study could be due to the course's selective status at the science teaching program, being ignored, or students' low attention towards course. But all science teaching department students' awareness towards sustainable development should be at adequate level. Because they will be teachers who give their students qualified sustainable development courses (Çobanoğlu & Türer, 2015). The most important factor that makes sustainable development awareness is its goals (Er Nas & Şenel Çoruhlu, 2017). In this direction, the views of the students of the science teaching department for sustainable development goals were taken. Considering the aims of sustainable development, it contains many areas where the needs of future generations can be met as well as the needs of today. When the answers given by the students were examined, it was concluded that they gave various examples from different fields regarding the aims of sustainable development. However, when the personal examples given by the students were examined, they did not cover all aims of sustainable development. As seen in Table 3, it was seen that the students mostly gave examples covering environmental and social issues. It was determined that they did not give enough examples of matters concerning the economic field. As a result of the study it seems that science teaching department students do not evaluate the purposes of sustainable development holistically.

The students of the science teaching department were asked about the contributions of sustainable development to the world by expanding the scope of the aims of sustainable development. According to the results of this study, the answers given to support the goals of sustainable development mostly include environmental and social issues. At the same time, it was determined that there are 42 (51%) students who evaluated their contribution to the world as environmental-social-economic.

The most important factor that comes to the fore in sustainable development is the change in energy use (Yıldırım & Nuri, 2018). Because, when sustainable development is considered with its environmental dimension, the use of renewable resources helps to protect the environment and reduce the damage to the environment (Yıldırım & Nuri, 2018). In this case, there is an important relationship between sustainable development and renewable energy. For this reason, in order to obtain more in-depth information about sustainable development awareness, students' views were taken on what the relationship between them was and what the benefits could be. Most of the science teaching students think that there is a relationship between sustainable development and renewable energy. Considering the established relationship, they stated that there is generally a positive relationship with the environment. In parallel with this result, according to the research results of Cebesoy and Karışan (2017), science teacher candidates stated that renewable energy sources are sustainable energy and environmentally friendly resources. However, few students think that renewable energy sources are economically costly and harmful to the environment. Again, according to Cebesoy and Karışan (2017), it was stated that there were teacher candidates who stated the negative aspects of these sources, but there were a small number of those who stated these negativities. Besides, it was determined that the majority of the students had positive or negative relationships in the environmental dimension, but did not establish enough social relationships.

In order to ensure sustainability, individuals should have the awareness of sustainable development, and it is stated that education is of great importance in order to bring sustainability awareness to individuals (Alkış, 2007). For this reason, the views of pre-service science teachers about how to increase the awareness of sustainable development in individuals were taken. According to the students' views, awareness about sustainable development will be increased utilizing verbal expression types, education, visual materials, and projects. Although the students made various suggestions to increase this awareness, they stated that they did not have enough of this awareness. Because of science teaching department students' inadequate sustainable development conscience, when they begin teaching they may have difficulties about giving their students sustainable development conscience. And it is thought that if teachers cannot give this conscience to their students, sustainable development purposes cannot be reached and the studies for a sustainable world cannot be carried out adequately. Another purpose of sustainable development is to use resources efficiently. Supporting this situation, it was emphasized in the Rio conference (1992) that one of the steps in the realization of sustainable development is the efficient use of resources (Ozmehmet, 2008). In this direction determining the knowledge level and awareness of pre-service teachers, who will educate generation Z, towards usage of resources economically is quite important. For this reason, the views of pre-service science teachers about the

economical use of resources were collected. According to the students' views, they stated that the economical use of resources can be achieved in various ways, such as reducing unnecessary use, increasing the awareness of individuals on this issue, and increasing recycling activities. Based on these expressions, it was concluded that the knowledge of the students about how to use resources economically was sufficient.

Projects for sustainable development are of great importance in ensuring sustainability. For this reason, in order to learn how much the students know about sustainable development projects, the students were asked whether there are projects in our country and what the projects are. Most of the students stated that projects were carried out in our country and they found these projects insufficient. However, in general, the teachers could not give concrete examples of sustainable development-oriented projects carried out in Turkey. Besides, when the students' knowledge about the projects was compared to their year level, it was concluded that the 3rd and 4th years students had more knowledge, but the fact that the students were at different year levels did not affect their lack of knowledge about this topic. Although 47 (58%) of the science teaching department students stated that projects were carried out for sustainable development, they could not exemplify the projects. These projects are located in the United Nations Development Programme official page Turkey (UNDP Turkey, 2019). Besides, campaigns are carried out for the production of electric cars, studies on recycling of wastes, the necessity of installing filters on factory chimneys, and recycling unused white household appliances (Ballı, 2019). As seen above, it has been determined that various studies are carried out in our country, but students do not have information about these studies. According to the results, students' inadequate knowledge about the projects is an indicator of their low awareness of sustainable development.

In line with the results obtained;

• In order to raise awareness of sustainable development to individuals, content on the subject should be increased on TV and social media channels.

• Since teachers have an important role in raising the awareness of sustainable development, the number of courses related to sustainable development for students studying in the teaching department should be increased, conferences should be given and their participation in activities should be ensured.

• In-service training for teachers should be increased.

• In order to access the individual projects carried out in Turkey adverts should be hung on street billboards.

• A person throwing litter on the streets may be fined, as stipulated in the laws of European countries on environmental sustainability.

• Within the framework of sustainable development, free concerts can be given to the public. Thus, individuals can have the awareness of sustainable development and efforts can be made to improve the environmental, economic, and social sustainability in our country.

• A qualitative study can be conducted to determine the differences between primary and secondary education teacher candidates' awareness of sustainable development by expanding the scope of the study on sustainable development.

• Quantitative and qualitative studies can be conducted on the sustainability behaviors of primary and secondary education teachers and teacher candidates.

Contribution Rate of the Researchers

All authors contributed to the manuscript equally.

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Conflict of Interest

The authors have disclosed no conflict of interest.

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