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SECONDARY SCHOOL EIGHTH GRADE STUDENTS' KNOWLEDGE AND THOUGHTS ON RECYCLING

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Abstract

The purpose of this research is to determine the knowledge and opinions of secondary school eighth grade students about recycling. The research was carried out as a case study design which is one of the qualitative research methods and the study group consists of 40 eighth grade students studying in a secondary school in Niğde Province of Türkiye. The data of the research were collected via a semi-structured interview form with students. The obtained data were analysed using content analysis by creating codes and themes. As a result of the research, students defined recycling mostly as reuse and stated that plastic, paper and glass are recyclable materials. In addition, it was determined that the students made the most waste separation practices among the recycling activities.

Keywords: Recycling; environmental education; secondary school students; knowledge and thoughts

1. Introduction

The developments taking place in technology and industry, the increase in the world population and the tendency towards modern life led to an increase in production, consumption and waste types and their amounts. Wastes significantly affect human health, natural life and

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ecology. The continuous use of limited natural resources, mining and increasing amount of waste produce damage on the world and ecology at a level that is much higher than tolerable (Erkinay Ozdemir, Ali, Subeshan & Asmatulu, 2021). The daily amount of waste per person in the world is 0,74 kg and the yearly amount of total waste produced is 2,01 billion tons. Although high income countries constitute 16 % of the world population, 34 % of this waste is produced by these countries (yearly gross national product over 12000 dollars). In addition, it is estimated that the world population will be 9.7 billion in 2050 and when it is taken into consideration that 90 % of the population will live in urban areas, it is estimated that the amount of waste will increase by 70 % and reach 3.40 billion tons (Wowrzeczka, 2021).

With the use of natural resources, waste loses its usefulness and financial value regardless of whether it is produced because of industrial, domestic or commercial process and becomes a harmful structure towards the environment. When its harms to the environment are taken into account, the types and amount of waste reaches dangerous levels and it becomes a necessity to reduce waste in environmental, social and economic terms. At this point, questions as to how waste should be reduced come to the picture (Akdoğan & Güleç, 2007). Since waste is produced because of using natural resources and the limit of natural resources decreases each day, the 3R approach is adopted widely in the world to reduce waste. The 3R approach is formulated and implemented as reduce, reuse and recycle (Seitz & Krutka, 2019; Virtanen & Nilsson, 2013).

The priority in waste hierarchy is Reduce, in other words prevention of formation of waste. The prevention of waste is the most economical and easiest step. The second priority is Reuse, in other words the reuse of waste where it cannot be prevented. The third priority is Recycle, in other words the inclusion of waste after a series of technical processes in production again and its reuse. The inclusion of recyclable materials such as glass, paper, plastic, etc. which we see in daily life in the production process again and their reproduction can be given as example to recycling (Artvinli & Bayar, 2018; Dinler, Simsar & Doğan, 2020). Recycling is considered as one of the most efficient methods to reduce environmental pollution and to preserve the world in a safer manner and is becoming an indispensable phenomenon to present a clean environment and livable world to all living beings (Lamma, 2021). Recycling reduces the amount of waste that goes regularly into storage areas each year, allows for the preservation of the area where natural resources and wastes are disposed of, prevents the risk of emission pollution that is caused by the leakage in regular storage area where wastes are burned and minimizes energy consumption, use of natural resources and air, soil and water pollution. In this manner,

environmental pollution is prevented, economic and social benefits are achieved; in other words, sustainable improvement becomes possible (Thenepalli, Chilakala & Ahn, 2019).

Around the world, recycling is a gaining for reducing environmental problems is gaining higher popular in alleviation of environmental problems. Increasing the rate and efficiency of recycling means increasing individual awareness about recycling and acting accordingly, reducing the amount of waste and energy use (Lehman & Geller, 2004). Individuals need to be awareness of this to carry out recycling activities. The biggest obstacle to recycling today is the lack of awareness, the negative attitudes and behaviors of individuals (Conke, 2018). For this reason, recycling awareness should be given from an early age. At this point, schools that provide education on recycling have important duties. As students gain environmental awareness in schools and have knowledge about recycling, they can learn the benefits of recycling more easily (Mutlu, 2013). Thus, students will understand the importance of recycling for the environment and our planet, and will gain knowledge, attitudes and behaviors about recycling (Artvinli & Bayar, 2018; Çimen & Yılmaz, 2012). In this respect, determining the knowledge and thoughts of students about recycling, which is the basic element of education, will make significant contributions to the literature (Altikolatsi, Karasmanaki, Parissi & Tsantopoulos, 2021; Avan, Aydınlı, Bakar & Alboga, 2011; Ceylan & Atabek Yiğit, 2019).

When the literature is analysed, there are studies on the analysis of the awareness, knowledge, attitudes, behaviours and views of individuals on recycling (Altikolatsi et al., 2021; Erdaş Kartal & Ada, 2020; İlhan, Doğan & Tosun, 2017; Kashyap & Iyer, 2014; Robertson & Walkington, 2009; Thoo, Tee, Huam & Mas'od, 2022; Ugulu, 2021; Wright, 2011). In general, a majority of these studies focus on undergraduate level. In the literature about recycling involving junior high-school students, there are studies on the perceptions (Nadi, Aghaabedi & Radnezhad, 2016; Mutlu, 2013), experiences (Atabek Yiğit & Ceylan, 2015; Demirel & Özcan, 2022), sensitivity (Ilgar, 2020), knowledge and behaviours (Çimen & Yılmaz, 2012; Mahmud & Osman, 2010) and views (Ceylan & Atabek Yiğit, 2019; Develi et al., 2017) of students. Although there is a wide variety of current studies on recycling, it was seen that studies on the knowledge and views of students in the 8th grade level are relatively few. Carrying out such studies in certain intervals and in a regional manner is more important due to the dynamic structure of the issue, compared to having a high of number of studies on the same subject. In addition, the knowledge and views of individuals on recycling affect their behaviours on recycling (Öktem, 2021). Therefore, it is important to identify the knowledge and views of 8th grade students on recycling. Moreover, the identification and analysis of the knowledge and views of eighth grade students on recycling will guide the precautions which need to be taken. In this light, the purpose of this study the

purpose of this research is to determine the knowledge and opinions of secondary school eighth grade students about recycling.

The questions guiding the study are as follows:

1. What are participants' definitions of recycling?
2. What are the participants' ideas about which wastes can be recycled?
3. What are the opinions of the participants about the necessity of recycling and the reasons for their opinions?
4. How do the participants of the study participate in recycling?
5. What recycling activities do the participants apply?
6. What are the opinions of the participants about how to raise awareness of recycling in schools?
7. What are the suggestions of the participants to raise awareness about recycling?

2. Method

2.1. Study design

With the purpose of identifying the knowledge and views of 8th grade students on recycling, this study was carried out based on case study design method. According to Yin (2003), case studies can be used to inform decision making mechanisms in some complex social phenomena or to determine the cause and effect relationship. In addition, it is necessary for the analysed issue to be current, the researcher not having any control on any situation and the analysed subject not to be manipulated to prefer case studies (Ozan Leymun, Odabaşı & Kabakçı Yurdakul, 2017). In this respect, case study design was preferred taking into consideration the current value of the issue of recycling and the researchers not having any control on it.

2.2. Participants

In this study, convenience sampling method was preferred in the selection of the school to be studied. The reason for selecting this method was the students at a school the researchers could easily access to accelerate the study process and make it more practical (Yıldırım & Şimşek, 2018). The students to participate from this school were determined through criterion sampling which is one of the sampling methods which is suggested to be used in qualitative studies. The criteria determined within the scope of the study were: the students needed to volunteer to

participate in the study and they needed to have received the education involving all subjects and gains on recycling in the Physical Sciences Lesson Curriculum. Accordingly, the study was carried out with 40 8th grade middle-school students who were receiving education in the second semester of the 2022-2023 academic year in Niğde which is a relatively small city in the Central Anatolian Region. 24 of the students were female and 16 were female. All students attend a public school located in the city centre. The secondary school where the research was conducted is an elite public school that is considered successful throughout the province. The general distribution in terms of socioeconomic level is at a medium level and is in harmony with the general profile of the city. In addition, the sample city characteristic is important as well. A sample city is a small city with a population of about 364 thousand people. This might present certain limitations compared to larger cities in terms of the recycling infrastructure. This should be taken into consideration when the results are evaluated.

2.3. Data collection tools

The study data were collected through semi-structured interviews done with the students. Prior to the interviews, semi-structured interview questions and an interview guide parallel to the research questions were prepared by the researchers on what recycling is, whether it is necessary or not, whether recycling activities are contributed to or not, what recycling activities are and what recycling should give students in schools. The guide which consists of six open-ended items was presented for the approval of two lecturers who are field experts on science and environment education areas and the guide which would guide the interviews was finalized in line with the views of the experts. Some items in the form are as follows:

- What do you think recycling means? What is recycling? Please explain with your own words.
- Do you think recycling is necessary? Explain why?

2.3.1. Data collection

After the finalization of the interview questions, a program was created through talking to the students one by one and according to this program, one of the researchers carried out the semi-structured interviews with the students. The interviews were done in an empty classroom of the school and outside disturbance was prevented during the interviews. During the interviews, the researcher made sure that the students felt at home, avoided guiding them and received approval

for the answers through mirroring technique in certain intervals. Each of the interviews lasted for about 35 minutes. The whole data collection process was completed in about two months.

2.3.2. Data analysis

Prior to the data analysis stage in the study, the preliminary preparations were made about the data. Within this scope, firstly the sound recordings uploaded to the computer were transcribed word by word and turned into written texts. Then, each of the texts were coded as S_1, S_2, S_3,…, S_{40}. After the data were prepared, they were analysed by one of the researches and an independent field expert according to the content analysis method. The data were analysed with Creswell's (2008) content analysis approach. According to this approach, the data were read twice, notes were taken if there were important points and a plan was made about how the data were going to be organized. Then, the data were coded one by one by the two experts independently. After this one by one coding process, similar codes were grouped together. Lastly, themes were created. Prior to finalizing the themes, the reliability coefficient was calculated between the coders. In this process, firstly the consistency of between the main themes were checked, then the students who were thought to be under each theme were checked. In these controls, discussion continued until 100 % consensus was reached. In the calculation of the codes and themes created from the study data, percentage and frequency were used. The study process is shown in Figure 1.

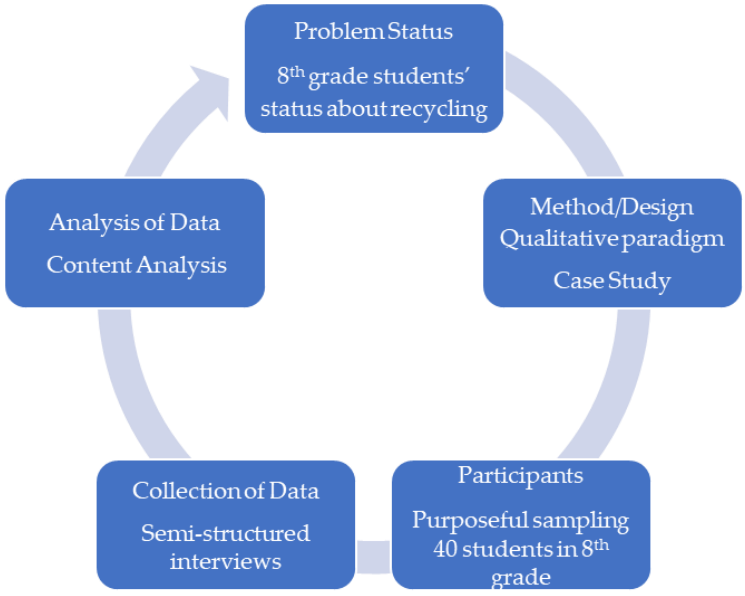

Figure 1. Study process

2.4. Validity and reliability

With the purpose of achieving the validity and reliability of the study, credibility (internal validity), transferability (eternal validity), dependability (internal reliability) and confirmability (external reliability) mechanisms suggested by Lincoln and Guba (1985) put to work. In this context, the views of the experts were asked throughout this qualitative study process to achieve credibility and the necessary corrections were made. To achieve external validity, the study was described in detail and the study group was determined through the purposeful sampling strategy. In order to achieve internal reliability, the study data were analysed with two field experts and the collection of the data and their analysis were explained in detail to achieve external reliability.

3. Results

In line with the study problem, the findings were presented successively as, definition on recycling and examples on recycling, the necessity of recycling, recycling activities and acquiring an awareness on recycling and suggestions to acquire sensitivity towards recycling.

3.1. Definitions on recycling

In the study, firstly the students were asked, "What do you think recycling means? Please explain." and their answers were received. The findings obtained through the analysis of the answers are given in Table 1.

Table 1. The students' definitions on the concept of recycling*

Code	f	%
Reusing	27	68
Reuse by changing unused materials	8	20
Creating new products from wastes	6	15
Reusing wastes that are not destroyed in nature	3	8
Efficient use of natural resources	3	8

* Participants' answers may contain more than one code.

27 of the students expressed recycling as reuse. About the meaning of recycling, S_{15}'s *"Recycling means that when the products we use are no longer reusable, they might be used up but can become reusable,"* expression and S_{38}'s *"Recycling is revising the products, resources when they are no longer usable and making them reusable,"* expression can be given as examples. Eight of the students defined recycling as changing unused materials and reusing

them, six of the students as creating new products from wastes and three students each as reusing wastes which are not destroyed in nature and economic use of natural resources.

Some of the students expressed recycling as reusing waste materials and not wasting natural resources in consideration of future generations. S_1's, *"Some wastes do not get destroyed in nature; reusing these or using natural resources like water economically and with awareness and using them over and over again are within the scope of recycling,"* expression can be given as an example.

The participants' answers show that the students experience confusion about reuse and recycling. In addition, it was determined that two students had no idea about recycling at all. One of these participants, S_6 expressed, *"I heard about recycling, saw its box but I don't exactly know what it is."* It was determined that two students confused recycling with zero waste, in other words, they had misconceptions about recycling. One of these participants, S_{20} expressed his/her thoughts as follows: *"Recycling is used to prevent the formation of wastes. Therefore, the amount of waste should be reduced."*

After the students' definitions on recycling, eighth grade students were asked, "Which substances can be recycled? Give an example." and their answers were received. The findings obtained through the analysis of the answers are given in Table 2.

Table 2. Substances which can be recycled according to the students

Code	**f**	**%**
Plastic	32	80
Paper	32	80
Glass	28	70
Organic wastes	13	33
Metals	12	30
Batteries	9	23

As a result of the analysis of the answers, it was determined that the answers given the most by the students were successively, plastic, paper, glass, organic wastes, metal and batteries. In reply to which substances can be recycled, S_{13}'s, *"Plastic bottles, glass bottles, paper, caps and many substances can be recycled,"* answer and S_{14}'s, *"All kinds of products made of plastic, glass bottles, used paper, card boxes and wastes made of metal,"* answer and S_{20}'s *"Almost all wastes. Fruit, vegetables, plants, trees, fossils, plastic,"* answer can be given as examples. Besides these answers, it was determined that two students regarded water as a recyclable

substance. In line with this thought, S8's reply was as follows: S_8: *"I'm not quite sure; paper can be recycled. I think water as well. I think that washbasin water is reused."*.

3.2. Necessity of recycling

The eighth-grade students were asked, "Do you think recycling is necessary? Explain why". All the students replied that recycling is necessary. The findings on why recycling is necessary are given in Table 3.

Table 3. The students' reasons about the necessity of recycling

Code	**f**	**%**
Recycling is necessary to save	21	53
Recycling is necessary since natural resources are depleted by time	19	48
Recycling is necessary for the protection of the environment	11	28
Recycling is necessary for the future generations	9	23
Recycling is necessary to reduce environmental pollution	4	10

When the answers about why recycling is necessary were analysed, 21 of the students expressed that it was necessary to be save. According to these students, recycling makes it possible to economize. S_{11}'s, *"Recycling is necessary. There is a production process for everything we use and this harms the environment. Consumption increases. But if we recycle wastes and use them, environment will not be harmed and it will be economic,"* answer can be given as an example. 19 of the students expressed that recycling is necessary because natural resources are depleted by time. In addition, 11 of the students expressed that recycling is necessary to protect the environment, 9 of the students stated that recycling is necessary for the future generations and four students stated that it is necessary to reduce environmental pollution. As example to these answers, S_{20}'s, *"If wastes are not recycled, resources will be depleted,"* S_{27}'s, *"The environment does not only belong to us, we need to think about the future generations as well. We should advocate recycling act economically and reduce consumption"* and S_{30}'s, *"Recycling reduces environmental pollution"* expressions can be given. Additionally, S_{37}'s answer, *"Of course recycling is necessary. If not people and the environment will get harmed. For instance, if we recycle glass bottles, it will not be a part of the production process again. And this both saves money and reduces the consumption of energy and dangerous gas emission to the environment during the production process. It is necessary if we think about the future generations,"* answer can be given as an example for all the views.

3.3. Recycling activities

The eighth-grade students were asked, "Do you separate products for recycling?" and their answers were received. The findings related to the answers are given in Table 4.

Table 4. Students' state of separating products for recycling

Code	**f**	**%**
Separates products for recycling	26	65
Not separating products for recycling	8	20
Being mindful of separating products for recycling	11	28

When the answers were analysed, it was seen that 26 students stated they separated products for recycling, 8 students stated that they were mindful of separating products for recycling. However, 11 students stated that they did not separate products for recycling. When the answers were evaluated in general, it was seen that more than half of the students stated that they engaged in recycling activities by separating products. In support of this view, S_{18}'s, *"Of course I separate products. We need to think about the future generations,"* answer can be given as an example. However, S_{21}'s, *"To be honest, I am only careful about batteries and sometimes paper. I cannot say that I am careful enough,"* answer shows that this student partially engages in recycling activities.

The students were asked the reasons why they do recycle and do not do recycling. In other words, it was questioned why they engaged or did not engage in recycling activities. The reasons expressed by the students are given in Table 5.

Table 5. Students' state of separating products for recycling.

Code	**f**	**%**
To protect the environment	21	53
To be save/contribute to economy	8	20
To think about the future generations	5	13

When the reasons stated by the students in relation to separating products for recycling were analysed, it was seen that 21 students stated that they do recycling to protect the environment, eight students stated to be economic/contribute to economy and five students to think about the future generations. S_{40}'s, "*Yes, I am in favour in recycling. Because I know that I protect the environment and contribute to economy by doing recycling"* and S_{17}'s, *"Recycling is necessary*

to protect the environment and I contribute to recycling firstly to protect the environment and to think about the future generations," expressions can be given as examples for the themes.

One of the students who stated that he/she did not contribute to recycling, S_{23}'s, "*I do not have recycling boxes to separate products and there are no organizations I can give separated products to even if I separate them. So, I do not contribute to recycling,"* answer can be shown as an example as to why he/she does not contribute to recycling. As it can be understood from S_{23}'s answer, the reason for not contributing to recycling is stated as insufficient infrastructure. Similarly, S_{37}'s, *"I do recycle but I cannot say that it is enough. Because suitable conditions are not provided; the facilities are insufficient,"* answer underlines that infrastructure is not sufficient. In addition, three students stated that they did not contribute to recycling but did not give any reasons.

The eighth grade students were asked "what they do within the scope of recycling activities?" and their answers were received. The activities carried out by the students for recycling are given in Table 6.

Table 6. The activities carried out by the students for recycling

Code	**f**	**%**
Separating products in recycling boxes.	25	63
Avoiding the use of harmful substances to the environment (such as plastic, nylon bags, etc.).	12	30
Disposing of organic materials in soil.	7	18
Warning other people who are insensitive to recycling.	3	8

25 students who did recycling stated that they separate products in recycling boxes, 12 students stated that they avoid using materials harmful to the environment (such as plastic, nylon bags, etc.), 7 students stated that they dispose of organic materials in soil and 3 students stated that they warn people who are insensitive to recycling. As examples to these statements, successively S_7's and S_{28}'s, **"***The environmental problems are so huge that the ecosystem is impaired more each day and one of the actions to be taken is recycling. I also avoid using plastic and dispose of organic wastes such as banana peels in soil,"* and *"To contribute to recycling, I separate wastes and recycle them. In addition, I warn others around me about the importance and necessity of recycling. Knowing that in fact recycling is contributing positively to the environment, not polluting the environment, carrying out activities that do not harm people,*

animal and plant life and being aware of these is among the reasons that can direct me to do more recycling," expressions can be given.

3.4. Acquisition of awareness of recycling

The eighth grade students were asked, "How do you think students can acquire awareness of recycling in schools?" and their answers were analysed. The findings related to the analysis of the answers were given in Table 7.

Table 7. Students' views on how awareness of recycling can be acquired in schools

Code	**f**	**%**
Carrying out activities that display the importance of recycling	29	73
Separating wastes in classrooms	23	58
Teachers acting as role models	14	35
Giving training to families	9	23

29 students stated that carrying out activities that display the importance of recycling fan help students acquire awareness of recycling. In addition, 23 students stated that separating wastes in classrooms, 14 students stated teachers acting as role models and nine students stated providing training for families can help in the acquisition of awareness of recycling. S_{32}'s, *"Activities that define recycling and show its importance should be organized. Teachers and families should be role models,"* and S_{12}'s, "*Firstly, there should be role models. There should be recycling boxes in classrooms and schools. Recycling can be explained through interesting documentaries, animations and recycling behaviours can be encouraged"* answers can be shown as examples.

3.5. Suggestions for the acquisition of sensitivity to recycling

The eighth grade students were asked, "What are your suggestions for the acquisition of sensitivity to recycling?" and their answers were analysed. The findings related to the analysis of the answers are given in Table 8.

Table 8. Students' suggestions for the acquisition of sensitivity to recycling

Code	f	%
Contact meetings (seminars, workshops, etc.)	29	73
Education at early ages	26	65
Social media	20	50
Modelling of possible consequences	5	13
Reward/punishment mechanism	3	8

A significant number of students stated that seminars and workshops should be organized, education on environmental pollution within the scope of recycling should start at early ages and social media should be used actively for the society to acquire sensitivity to recycling. According to these answers, it can be stated that the participants give importance to raising the knowledge level on recycling. S_{16}'s, *"I think that children should learn about environmental problems, recycling at important-early ages at the kindergarten stage. In addition, if the social media is used actively, successful outcomes can be achieved,"* answer can be shown as example to these views.

In addition, some of the participants suggesting the modelling of possible consequences and using the reward/punishment system. S_{26}'s, *"Firstly, we need to create environmental awareness and individually understand the importance of recycling. Therefore, seminars, posters can be made use of. For some people, punishment is necessary. If there are no sanctions, people do not obey the rules,"* statement can be shown as example to these suggestions.

4. Discussion and Conclusions

This study aimed at identifying the knowledge level and views of eighth grade students on recycling. Firstly, the students were asked what recycling is and secondly, there were asked what kind of substances can be recycled and their answers were received. In the study, more than half of the students defined recycling as reuse, one fifth of the students defined it as changing unused materials and reusing them. In addition, some of the students defined recycling as creating new products from wastes and reusing wastes that do not get destroyed in nature.

At this point, it is not clear whether the students mean the reuse of wastes by creating new products after a series of physical and chemical processes technically or reusing products for other purposes in their definitions. The students did not make clarifications and give further information about this. This gives rise to the thought that the students confused Recycling with Reuse at the point of usability (Atabek Yiğit & Ceylan, 2015; Demirel & Özcan, 2022; Dinler et al., 2020; Harman & Çelikler, 2016; Ural Keleş & Keleş, 2018). It was determined in this

study that the eighth grade students have limited knowledge on recycling. There are parallel findings in the literature (Dinçol Özgür 2020; Erdaş Kartal & Ada, 2020). Similarly, in İlhan and others' (2017) study on first graders, it was seen that one third of the students did not know what is done with the wastes thrown in the recycling boxes, in other words they did not have any idea what recycling is. However, a majority of the students stated that waste products turn ingot new products and are reused. In Soran and others' (2000) study with biology teacher candidates, only one third of the students defined recycling as "recovery of or turning wastes into useable products after reprocessing them through a series of operations." The limited knowledge of students on recycling might be due to a lack of a lesson directly related to environmental education or the insufficient level of curriculum (Mutlu, 2013). Insufficient knowledge about the environment leads to a low level of protection capacity, attitude and behaviours towards the environment in individuals (Debrah, Vidal & Dinis, 2021). However, it can be seen in some studies in the literature that individuals have sufficient knowledge on recycling (Çimen & Yılmaz, 2012; G. Demircioğlu, H. Demircioğlu, & Yadigaroğlu, 2015; Yılmaz, Morgil, Aktuğ & Göbekli, 2002). In this study, the eighth grade students defined recycling as "revaluating waste materials and not over using natural resources in consideration of future generations." It is indicated that students who do recycling have a more sustainable life-style (Maji, 2022). Therefore, it is considered that students associate recycling with sustainable development.

A majority of the students gave the examples of plastic, paper and glass for recyclable materials. Less than half of the students have the examples of organic wastes, metal and batteries for recyclable materials. There are similar results in the literature (Atabek Yiğit & Ceylan, 2015; Demirel & Özcan, 2022; Dinler et al., 2020; Demircioğlu et al., 2015; Soran et al., 2000). Only two of the students expressed that water is recyclable. On the other hand, it is noteworthy that students did not mention composites, oil and chemical wastes as examples although these are recyclable (Demirel & Özcan, 2022). The possible reason for this situation may be that the infrastructure support for the recycling of these materials is not widespread in the province of Niğde, where the research was carried out. The fact that recycling bins are made of solid waste may be another reason for this situation. Similarly, in Harman and Çelikler's (2016) study with science teacher candidates, it was reported that the teacher candidates have awareness on the definition of recycling, but not enough knowledge about recyclable materials.

Thirdly, the students were asked, "Do you think recycling is necessary? Explain why?" and their answers were received. When the students' answers on the necessity of recycling were analyzed, it was seen that all the students stated that recycling is necessary. As for why recycling is necessary, more than half of the students expressed saving money and a little less than half of

the students expressed the depletion of natural resources by time as reasons. A low number of the students stated in consideration of future generations and to reduce environmental pollution as reasons for the necessity of recycling. This may be because, as Diekmann & Preisendörfer (1992) explained in Low-cost/High-cost theory, individuals first focus on behaviors that are beneficial and easy to do while performing environmentally beneficial behaviors. Ultimately, savings also benefit individuals themselves. These findings of the study are in agreement with the literature (Ceylan & Atabek Yiğit, 2019; Demirel & Özcan, 2022; Dinler et al., 2020; Harman & Çelikler, 2016).

Fourthly, the students were asked about recycling activities and their answers were received. More than half of the students stated that they did not separate products for recycling and one fifth stated that they did not separate products. However, close to one third of the students stated that they did not give importance to separating products for recycling. The students defined recycling activities the most as protecting the environment, being save/contributing to economy and considering the future generations. The students who did not contribute to recycling stated that the reason was insufficient infrastructure. In Ceylan & Atabek Yiğit's (2019) study, it was determined that middle-school students who do not do recycling stated insufficient number of recycling boxes was the reason. Therefore, this finding is in line with the reason of not participating in recycling activities due to insufficient infrastructure.

Fifthly, the students were asked, "How do you think students can acquire awareness of recycling in schools?" and their answers were analysed. The analysis of their answers showed that about two-thirds of the students stated that awareness of recycling can be acquired through carrying out activities that display the importance of recycling. In addition, the students stated successively that acquisition of awareness of recycling can be possible by separating wastes, students and teachers being role models and organizing training for families. In Dinler and others' (2020) study with preschool teacher candidates, it was reported that acquisition of awareness of recycling can be possible by raising the awareness of individuals. In addition, the participants stated that the media, conferences and posters should be used; laws, punishments and rules should be made effective and awareness training should be given. In Erdaş Kartal and Ada's (2020) study on preschool teacher candidates, the teacher candidates were asked what they individually do about wastes. More than half of the teacher candidates stated that they used recycling points, close to one-fifth stated that they separated wastes, a very small number stated they informed people and increased recycling points.

Lastly, the participants made suggestions such as organizing contact meetings like seminars and workshops, providing education on environmental problems within the scope of recycling

at early ages, using social media actively and modelling the possible consequences for acquisition of awareness of recycling. These findings are in parallel with the findings of some of the studies in the literature (Dinler et al., 2020; Yoldaş, 2021). In addition, it is suggested in the literature to organize scientific trips to recycling factories for students (Demirel & Özcan, 2022).

4.1. *Practical implications*

In line with the results of the research, the following suggestions for practice can be made:

- In the research, it was determined that there is a misconception between the concepts of reuse and recycling and there is a lack of information about recyclable materials. Therefore, trainings and information meetings can be given to all segments of the society on the differences between the concepts of reuse and recycling, how the recycling mechanism works, recyclable materials and the necessity of recycling.
- Conferences, seminars and workshops can be organized. Documents such as informative posters, banners and brochures can be prepared. A public notice can be created. Practical training can be given in schools. Out-of-school learning activities can be carried out at the recycling facilities in the provinces.
- Environmental education can be made a compulsory course at all levels of education, starting from the pre-school period. It would be appropriate to pay attention to the fact that the course is applied while conducting the course.
- It is necessary to strengthen the recycling infrastructure in the provinces and increase participation in recycling activities.

4.2. Limitations and future studies

As it is the case for all scientific studies, the present study also has certain limitations. Firstly, within the scope of the research methodology, a questionnaire of closed questions was used to reach many teachers. This may have resulted in invalid answers and lack of detailed data as the method does not involve direct interaction with the participants. Therefore, it would be more interesting to conduct future studies by using the method of semi-structured interviews and observations and by examining student and teacher journals concerning outdoor of school

education. Once again, a scale would also help with the collection of quantitative data from an extended sample; alternatively, a mixed research method might also be preferred.

The research sample may be another limitation of the study. As indicated before, the present study was conducted with pre-school teachers working in a relatively small city. This might be an asset in terms of factors such as transportation-related opportunities within small cities, but it also entails certain disadvantages like the inadequate numbers of outdoor learning environments when compared with metropolises like Istanbul or Izmir. Based on this, one suggestion for future research might be selecting pre-school teachers working in a metropolis as the research sample and making a comparison between teachers working in smaller cities and those working in big cities. Furthermore, the data of the present study suggest that the young age of pre-school children render the activities more difficult. Therefore, a comparison might be made by collecting opinions from teachers working with students at different levels, such as middle and high schools.

Finally, as it is the case in Turkey, most of the pre-school teachers included in the research sample are female. This prevented the researchers from examining the question of whether gender affects participant opinions. Future quantitative studies with a more extensive research sample might also look at the influence of gender. Furthermore, the impact of other variables such as professional seniority, regions of schools, and socio-economic statuses of families may also be considered.

Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest.

References

Akdoğan, A., & Güleç, S. (2007). Sustainable solid waste management and a research on the analysis of managers' thoughts and attitudes in respect to solid waste management in municipalities. *Hacettepe University Journal of Economics and Administrative Sciences, 25*(1), 39-69.

Altikolatsi, E., Karasmanaki, E., Parissi, A., & Tsantopoulos, G. (2021). Exploring the factors affecting the recycling behavior of primary school students. *World, 2*(3), 334-350.

Atabek Yiğit, E., & Ceylan, Ö. (2015). Utilization of flow maps in the determination of cognitive structure of secondary school students regarding the concept of recycling and reuse. *International Online Journal of Educational Sciences, 7*(2), 155-166.

Artvinli, E. & Bayar, V. (2018). Recycling as a value in primary and secondary curriculums. *Osmangazi Journal of Educational Research (OJER), 5*(1), 18-34.

Avan, C., Aydinli, B., Bakar, F., & Alboga, Y. (2011). Preparing attitude scale to define students' attitudes about environment, recycling, plastic and plastic waste. *International Electronic Journal of Environmental Education, 1*(3), 179-191

Ceylan, Ö., & Atabek Yiğit, E. (2019). Determination of thoughts of secondary school students about recycling. *Turkish, Studies Educational Sciences, 14*(3), 461-477.

Creswell, J.W. (2008). *Educational research: planning, conducting, and evaluating quantitative and qualitative research* (Third edition). New Jersey: Pearson Education Ltd.

Conke, L. S. (2018). Barriers to waste recycling development: Evidence from Brazil. *Resources, conservation and recycling, 134*, 129-135.

Çimen, O., & Yılmaz, M. (2012). Recycling knowledge, behaviors, and attitudes of primary school students. *Journal of Uludag University Faculty of Education, 25*(1), 63-74.

Debrah, J. K., Vidal, D. G., & Dinis, M. A. P. (2021). Raising awareness on solid waste management through formal education for sustainability: A developing countries evidence review. *Recycling, 6*(1), 6.

Demircioğlu, G., Demircioğlu, H., & Yadigaroğlu, M. (2015). The assessment of environmental consciousness levels of physics, chemistry and biology student teachers. *Adiyaman University Journal of Social Sciences, 8*(19), 167-193.

Demirel, R., & Özcan, H. (2022). Exploring 7th grade students' lived experiences about domestic waste and recycling after attending a scientific trip. *Kastamonu Education Journal, 30*(2), 297-311.

Develi, E., Gürsoy, H.H., Özçelik, E., Emik, H., Yavuz, G., Yalçın, M.N.A & Kara, E.E. (2017). Investigation of middle school student's views towards to recycling of packaging waste: (The case of Nigde). *International Journal of Social Sciences in Turkish Cultural Geography, 2*(1), 86-100.

Diekmann, A., & Preisendoerfer, P. (1992). Persoenliches Umweltverhalten: Die Diskrepanz zwischen Anspruch und Wirklichkeit. *Koelner Zeitschrift fuer Soziologie und Sozialpsychologi e, 44*, 226–251.

Dinçol Özgür, S. (2020). Examining prospective teachers' awareness of recycling in terms of various variables. *Erzincan University Journal of Education Faculty, 22*(3), 837-856.

Dinler, H., Simsar, A., & Doğan, Y. (2020). Investigation of pre-service early childhood teachers' thoughts about recycling. *Journal of Child and Development (J-CAD), 3*(5), 1-11.

Erdaş Kartal, E., & Ada, E. (2020). Recycling from the perspective of pre-school children. *Journal of Uludag University Faculty of Education, 33*(3), 778-801.

Erkinay Ozdemir, M., Ali, Z., Subeshan, B., & Asmatulu, E. (2021). Applying machine learning approach in recycling. *Journal of Material Cycles and Waste Management, 23*, 855-871.

Harman, G., & Çelikler, D. (2016). Awareness of science teacher candidates on recycling. *AIBU Journal of Social Sciences, 16*(1), 331-353.

Ilgar, R. (2020). The recycling phenomenon and the sensitivity of 5., 6., 7. and 8. class students to recycling in Çanakkale samples. *Turkish Academic Research Review, 5* (4), 493-510.

İlhan, N., Doğan, Y., & Tosun, C. (2017). The investigation of first grade students' knowledge, awareness and attitudes about recycling. *International Online Journal of Educational Sciences, 9*(1), 174-190.

Kashyap, R., & Iyer, E. (2014, October). Attitudes and behaviors of college students in regards to the environment and recycling. In *New Meanings for Marketing in a New Millennium: Proceedings of the 2001 Academy of Marketing Science (AMS) Annual Conference* (pp. 71-79). Cham: Springer International Publishing.

Lamma, O. A. (2021). The impact of recycling in preserving the environment. *IJAR, 7*(11), 297-302.

Lehman, P. K., & Geller, E. S. (2004). Behavior analysis and environmental protection: Accomplishments and potential for more. *Behavior and social issues, 13*, 13-33.

Lincoln, S. Y., & Guba, E. G. (1985). *Naturalistic inquiry.* Thousand Oaks, CA: Sage

Mahmud, S.N.D., & Osman, K. (2010). The determinants of recycling intention behavior among the Malaysian school students: an application of theory of planned behavior. *Procedia-Social and Behavioral Sciences, 9*, 119-124.

Maji, P.K. (2022). Measuring Recycling Practice to Promote Sustainable Lifestyle in the Context of Environmental Education. *CHETANA- International Journal of Education, 7*(2), 123-141

Mutlu, M. (2013) "Recycling" concept perceptions of grade eighth students: A phenomenographic analysis. *The Anthropologist, 16*(3), 663-669. **https://doi.org/10.1080/09720073.2013.11891391**

Nadi, M.A., Aghaabedi, E., & Radnezhad, H. (2016). Effectiveness of teaching recycling on the perception concept of recycling in sixth grade female students. *J Earth Environ Health Sci 2,*116-21.

Ozan Leymun, Ş., Odabaşı, F., & Kabakçı Yurdakul, I. (2017). The importance of case study research in educational settings. *Journal of Qualitative Research in Education, 5*(3), 367-385.

Öktem, A.G. (2021). *Investigating the determinants of university students' recycling behavior* [Unpublished master's thesis]. Hacettepe University Graduate School of Social Sciences, Ankara

Robertson, S. & Walkington, H. (2009). Recycling and waste minimization behaviors of the transient student population in Oxford: results of an on-line survey, *Local Environment, 14*(4), 285-296. https://doi.org/10.1080/13549830902812982

Seitz, R. Z., & Krutka, D. G. (2019). Is recycling sustainable?: An ecological inquiry. *Editor: Jessica B. Schocker Associate Editor: Sarah B. Brooks*, *39*(1), 5.

Soran, H., Morgil, F., Yücel, S., Atav, E., & Işık, S. (2000). Researching biology students' interest in environmental subjects and comparison with chemistry students. *Hacettepe University Journal of Education, (18).* 128 – 139.

Thenepalli, T., Chilakala, R., & Ahn, J. W. (2019). Sustainable environmental science & recycling technology education for high school and middle schools: Global scenario. *Journal of Energy Engineering*, *28*(1), 45-48.

Thoo, A.C., Tee, S.J., Huam, H.T., & Mas'od, A. (2022). Determinants of recycling behavior in higher education institution. *Social Responsibility Journal*, *18*(8), 1660-1676.

Ugulu, I. (2021). Recycling attitudes of prospective special education teachers. *Online Submission*, *9*(6), 1574-1578.

Ural Keleş, P. & Keleş, M. İ. (2018). Perceptions of the 3rd and 4th grade students of elementary school about the concept of "recycling". *Erzincan University Journal of Education Faculty*, *20*(2), 481-498.

Virtanen Y. & Nilsson S. (2013), Environmental impacts of waste paper recycling. Routledge, London

Wowrzeczka, B. (2021). City of waste—importance of scale. *Sustainability*, *13*(7), 3909.

Wright, Y. L. (2011). Relating recycling: Demographics, attitudes, knowledge and recycling behavior among UC Berkeley students. *UC Berkeley Student Recycling*.

Yıldırım, A. & Şimşek, H. (2018). *Qualitative research methods in social sciences*. Ankara: Seçkin Publishing.

Yılmaz, A., Morgil, F. İ., Aktuğ, P., & Göbekli, İ. (2002). Knowledge of the secondary school and university students on the environment, environmental concepts and problems and suggestions. *Hacettepe University Journal of Education, 22*(22), 156-162.

Yin, R.K. (2003). *Case study research: Design and methods*. Thousand Oaks, CA: Sage:

Yoldaş, A. (2021). *11th grade students' views on waste and recycling in geography lesson* [Unpublished master's thesis]. Atatürk University institute of education sciences, Erzurum.