COMPARISON OF TRADITIONAL AND COMPUTER-BASED INSTRUCTION ON THE THEME OF RECYCLING

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COMPARISON OF TRADITIONAL AND COMPUTER-BASED INSTRUCTIONS ON THE THEME OF RECYCLING

In today's development, the general objective is achievement of desired progress on one hand and maintenance of good quality living conditions on the other. The sustainability of these goals depends on our relationship with the environment and how well we take care of it as we progress technologically. In this context, environmental education has crucial importance. This study aims to determine what kind of an instructional design should be implemented for teaching the recycling topic efficiently.

This research compares traditional and computer-based instructional designs on the theme of recycling, each having the same content and flowchart. The effects of these two instructional designs on learning are evaluated based on comprehension and attitude outputs of the study group consisting of 3rd grade primary school students.

Findings note that the performance of the groups increased with both designs. However, the results show that neither one of the instructional designs lead to a greater impact than the other one on achievement. It is concluded that recycling can be taught in either design, depending on the conditions of the learners and the learning environment.

GERİ DÖNÜŞÜM KONUSUNDA KLASİK VE BİLGİSAYAR TABANLI ÖĞRETİMİN KARŞILAŞTIRILMASI

Günümüz kalkınmasında genel amaç, istenen ilerlemenin sağlanmasıyla birlikte, iyi yaşam şartlarının da korunmasıdır. Bu hedeflerin sürekliliği, çevre ile ilişkimize ve teknolojik ilerlemede bunu ne kadar iyi gözettiğimize bağlıdır. Bu kapsamda, çevre eğitimi büyük öneme sahiptir. Bu çalışmanın amacı, geri dönüşüm konusunun verimli öğretimi için nasıl bir öğretim tasarımı oluşturulması gerektiğini belirlemektir.

Bu araştırma, geri dönüşüm teması için, aynı içerik ve akış şemasına sahip klasik ve bilgisayar tabanlı öğretim tasarımlarını karşılaştırmaktadır. Bu iki öğretim tasarımının öğrenmeye etkisi, ilköğretim 3. sınıf öğrencilerinden oluşan çalışma grubunun bilgi ve tutum çıktıları ile değerlendirilmiştir.

Bulgular, grup performanslarının her iki tasarımla da arttığını göstermiştir. Bununla birlikte, sonuçlar iki tasarımın da başarı için diğerinden daha etkili olmadığını göstermiştr. Buradan, geri dönüşüm konusunun, öğrencilerin ve öğretim ortamının durumuna göre bu iki tasarımdan herhangi biriyle öğretilebileceği sonucuna varılmıştır.

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1. INTRODUCTION

1.1. Problem of the Study

Due to increased population growth and technological advances, the physical world and humans have experienced significant changes in the last centuries. These changes brought both positive and negative results. Industrial progress made our lives easier, medical developments found solutions to various kind of illnesses and increased average life expectancies, automated production led to availability of modern products for a greater number of people, communication networks helped us stay connected more than has ever been possible before. But at the same time, the environment was polluted, nature was destroyed, species became extinct, and new kind of illnesses emerged. As a response, modern technology itself tried to stop -or at least, decrease- the negative impacts that it caused at the first place, however, some of the results of the impacts were irreversible.

In order for development to occur without harming the planet that we live in, we have to consider the environment. It is known that human understanding and attitude towards the outside world are mainly shaped in early childhood (Erden and Akman, 2001). Thus, it is of importance to integrate environmental topics into in- and out-of-school educational practices for attaining positive understanding and attitudes towards the environment.

In recent years, since computers started being widely used in education, various subjects have been taught using software programs. Computers, as interactive educational guides, can lead to an increase in learning (Roblyer, 1988; Alessi and Trollip, 1991; Clarebout and Ellen, 2006). Likewise, it is also widely accepted that common traditional instruction in classrooms affects learning positively (Wheldall and Glynn, 1989; Ashman and Conway, 1993; Arends; 1997). However, as explained in greater detail in section 2.2.4, contribution of traditional and computer-based instructional designs for learning and utilizing new information differs based on the topic of interest.

Combining these points about the environment and education, it can be concluded that it is essential to determine the effect of instructional designs on learning particular environmental topics. In this context, recycling stands out as an essential component of environmental education. Accordingly, this study presents and compares two designs in their broadest frame, traditional classroom instruction and computer-based instruction, on the theme of recycling, by focusing on the outputs of the learners.

In this study, the term “traditional instruction” refers to the conventional classroom lectures where subject-centered curriculum design dominates and is in wide use since before and now in schools. In the same context, the term “computer-based instruction” in the study also refers to a subject-centered design, but used for the instruction which is delivered to learners through software with the use of computer technology.

1.1.1. Environmental Degredation and Counter-Measures

Today, over 7 billion people are using the earth’s natural resources. They are cutting forests, polluting the air, water, and soil, releasing hazardous wastes, or shortly; continuously harming nature. As pressure from overpopulation and development increases, satisfying people’s needs and desires becomes harder. Consequently, it becomes almost impossible to escape the consequences of severe environmental pollution and degradation; extinction of species, desertification, pesticide contamination, health problems, starvation, poverty, loss of lives, and so on. It is predicted that if the current rate of destruction continues, there will be a gradual breakdown of the systems that support life on earth (Coccia, 2014; Wiltshire et al., 2013).

Throughout the history of the world, the human impact on the environment has gradually increased (Tickell, 2006). Before the industrial revolution began, effects of human activity on the environment were local, or at most regional, rather than global in scale (Hornborg, 2006; Goldemberg, 1994; Ashton, 2009). More recently, in the last decades, the effect of humans on the environment started to cause significant deviations in the natural balance of the globe (Nordell, 2003; Liu et al., 2008). Due to the demands of increasing population and technology, our world is being damaged irrecoverably, and the problems of environmental pollution and degradation are becoming more complex, resulting in higher risks for nature (Babu, 2005).

Environmental pollution refers to the contamination of air, water, and soil, leading to various global problems including depletion of the ozone layer, global warming, and climate change (Zhu et al., 2007; Jones and O’Neill, 1992). On the other hand, environmental degredation refers to the degeneration of the environment through consumption of natural resources and destruction of ecosystems (Rozelle et al., 1997; Bird, 1992).

These threats, which have also been pointed out by the UNEP (2012), show the need for increased environmental awareness to reduce their impact now, as well as their consequences that we will continue to suffer from, both regionally and globally, in the near and distant future. Given that humanity has changed the natural balance of the world, through both personal daily activities and large scale industrial actions, there is an undeniable need for adjustment of human understanding and attitude on the environment. Such adjustments can be grouped under two titles; environmental protection and environmental remediation.

Environmental protection is the practice of protecting the environment, at individual, organisational or governmental levels, for the benefit of the natural environment and humans (Hamilton and Macintosh, 2008; Venselaar, 2005). In this sense, the basis of protection lies in education, starting from elementary stages. Saving energy, protection of nature, and recycling can be listed as main topics of environmental protection. On the other hand, environmental remediation deals with the removal of pollution or contaminants from soil, water, or air (Franz and Hefter, 1999; Rodriguez and Paustenbach, 2009), where efforts are limited, inadequate, or lacking. In this sense, compared to protection, remediation requires more professional knowledge and skills in order to be able to handle such higher level practices.

Certainly, efforts for remediation are of great importance, however, unless a basic understanding of the value of the environment is acquired, these efforts will not have long-lasting effects. In this sense, fundamentally, early stages in education stand as an essential component in the dynamics of environmental protection. In short, as well as trying to solve the existing condition by “fine-tuning” the end products, we must look at the origins of the problem, one of which lies in environmental awareness and relevant education.

1.1.2. Environmental Awareness and Education

Environmental awareness refers to the understanding of concerns about environmental conservation and the interaction between humans and the environment. It is often associated with the term sustainability, which means “the capacity to endure”. Many of the systems and habits of today are unsustainable, and developing sustainable use of natural resources requires collaboration and education of people.

Environmental education, on the other hand, refers to the learning process with the output being an increase in the knowledge and awareness about the environment

(Heimlich, 2010; Ruchter et al., 2010; Carleton and Hug, 2010). The term is often used to imply education within the school system, however, it also includes efforts to educate the public.

Success of an instruction on environment can be best evaluated by its outcomes, which is related to its direct and indirect effects on a particular topic of interest, as in the understanding and attitude of individuals towards environment. Instructions should guide people to feel that they personally contribute to the problems to an extent, and motivate them to actively participate in finding solutions, whereby they understand that they are part of the nature (Schultz et al., 2004).

Integrating environmental subjects into curricula at schools can increase awareness towards the environment. The subjects can be integrated into existing courses or can be taught seperately, which can span from elementary education to adult programs. Today, each age category of primary school students comprise nearly 1.66% of the world population (IDB, 2015), and their way of thinking is already shaping the world of both today and tomorrow. Preparing programs for the involvement of youth in environmental protection has been internationally recognised as a critical component of sustainable development (UNEP, 2012).

1.1.3. Recycling

Recycling is the process of collecting and processing materials that would otherwise be thrown away as trash, and turning them into new products. The benefits of recycling for both the environment and communities are obvious. Due to its ease of implementation, it can be understood and practiced at any life stage, starting from childhood. Benefits of recycling can be summarized as; reducing the amount of waste sent to landfills and incinerators, conserving natural resources, preventing pollution, saving energy, as well as generating new jobs for people (EPA, 2014). There are several methods for collecting recyclables, including curbside collection, individual bins, drop-off centers, and deposit programs. Collection is followed by the process where recyclables are sent to recovery facilities to be sorted, cleaned, and processed into materials that can be used in manufacturing.

Today, a greater variety of products are being manufactured with recycled content. Common daily items that contain recycled materials include newspapers, cloths, cartoons, cans, plastics, glasses, and composite containers. Recycled materials are also used in industry, to form secondary materials such as recovered glass in asphalt or recovered plastic in carpeting. In consumption, it is important to look for products that can be easily recycled or contain recycled content. Buying these products helps to close the "3-stage loop" in recycling: collection of the recyclable product, processing it, and consuming the new product.

Recycling, hence, is a key component of modern waste management, and is the third of the 3Rs; reduce, reuse, and recycle. The order of the triple R comes from the management options of their environmental impact; from the most favoured to the least, where the aim is to extract the maximum benefits from products and to help generate the least amount of waste.

1.1.4. Recycling Theme in Turkish Compulsory Education

In the national curriculum for primary schools in Turkey, the initial years cover compulsory fundamental courses. The program of the first three years in this period consist of Turkish, Mathematics, Life Studies, Fine Arts, Music, and Games and Physical Activities courses, as well as the Foreign Language course which begins to be taught in the 2nd year. Specifically, basic concepts and principles of recycling are currently included under the Life Studies course, since May 2009 (MEB, 2010), as given in Appendix A. Each Life Studies course is divided into three chapters; *"Okul Heyecanım"*-My School Enthusiasm (MSE), *"Benim Eşsiz Yuvam"*-My Unique Home (MUH), and "*Dün, Bugün, Yarın"*-Yesterday, Today, and Tomorrow (YTT). In the first year, MSE and MUH emphasize proper behaviors in consumption at school and at home, whereas YTT deals with the change of materials through time, and human effect on the environment. In the second year, MSE and MUH emphasize personal consumption at school and at home, while YTT focuses on the needs of living organisms, together with the similarities and differences between the natural and artificial environment. In the third year, MSE expects students to generate alternatives for problems that arise from improper use of materials, and to design projects that demonstrate care for the environment. The MUH in this grade covers the separation of products according to their origin, the consumption-budget relationship, and the effect of individual behaviors on global issues. In the end, YTT mentions the cycling processes in nature, the relationships and effects of organisms on each other, the mutual dependence among the individual, the society, and the environment, and the cleanliness of neighborhoods where children live (MEB, 2010).

1.1.5. Aim of the Study

The primary objective of this study is to conribute to environmental and educational literature by comparing the effect of two instructional designs in teaching basics of recycling to children. With the comparison of traditional and computer-based instructions, it is aimed to determine if either of these approaches has a greater effect in helping students understand the concept and show the relevant attitude. The results are expected to provide fundamental data to the specialists in the efforts to increase recycling rates, and an idea on the design and delivery of instruction to be used for further particular subjects.

School education seems to be unable to sufficiently address the significance and increasing rapidity of changes to our lives and lifestyles, which also include environmental issues (Gidley and Hampson, 2005). In this respect, when we consider education at schools, it is important to determine which designs best fit a course content, or a particular title. Obviously, many subjects taught in school programs are important, and several of these are even more important than others. For instance, cardiovascular problems account for 50% of mortality rates globally, and an effective CPR can double the chance of the survival of a victim (AHA, 2013). Recognizing the importance of CPR in saving lives, the WHO advises countries to step-up their activities in the provision of relevant education. Likewise, while outputs of first aid courses have direct vital effects in certain cases, recycling courses also represent an important goal, though in a more collective perspective. In a parallel manner with the WHO, the UNEP notes the importance of recycling practices, which also demonstrates the increasing global demand (UNEP, 2012).

Although the strengths of traditional and computer-based instructions are obvious, many applications are not perfectly well designed, and cannot fully supply positive effects of the learning environments and materials on learners. Possessing an effective traditional and/or computer-based design is a great advantage, but it can turn into a considerable waste of time and resources if the media is not adequately considered while designing the program (Kinshuk and Patel, 1997).

In Turkish compulsory education today, Life Studies course partially cover environmental issues by focusing on human-environment interactions and human dependence on nature, natural cycling processes of the earth, conscientious consumption, care of local environments, man-made natural disasters, and the cumulative effect of individual behavior on global issues (MEB, 2010). The topic of recycling is covered only in the Yesterday-Today-Tomorrow chapter of the Life Studies course of 3rd graders, on page 172 in the Students Book, along with pages 160 and 161 of the Practise Book (Özcan, 2012). Specifically, in the Students Book, a short conversation between a father and son is provided, where the attention of students is intended to be captured with a news piece on producing DVDs from corn. The conversation also partially covers the collection of recyclable items separately, the saving of 20 trees by recycling 1000 kg of paper, and the reduction of air and water pollution through recycling. The section ends with an assessment on finding things to do for local areas in order to increase general cleanliness. Subsequently, the Practice Book invites students to prepare an informative brochure on recycling for the neighbourhood, classifying and finding a re-use idea for three different items, and describing the complete factory process for the recycling of glass by looking at the relevant figures (Appendix A).

The review of the textbook of the Ministry of National Education, MEB, revealed several contextual and methodical shortcomings. Firstly, considering recycling, the subject is vaguely presented. There are not adequate explanations about the importance of selection of recyclables and relevant processes. Secondly, expressions had no relevance to children’s daily life, the only example referred to the tranformation of corncobs into DVDs. In addition, importance of recycling was not well presented, the only information about it was the relation between the amount of paper collected and the number of trees left uncut. In a parallel manner, concepts such as energy saving and decreasing the amount of wastes are not mentioned. Moreover, plastics, which are one of the leading recyclables, are not mentioned in the textbook. Likewise, metals, which are one of the leading waste materials in classrooms in the form of beverage cans, are not covered essentially. Finally, in this context, for the recycling loop, it should be noted that the section in the lecture book only covers the loop for glass, but not the other three basic materials.

In this perspective, considering the extremely limited coverage of recycling in the textbook, this study also aims to present a more comprehensive instructional context with two optional designs. This experimental study compares traditional and computer-based designs, to test the probable difference between the performance of learners in understanding and practicing the concept. The intended approach of this study can be helpful for guiding educators and authorities on the subject of recycling both to contribute to the efforts for enhancing the course program and recycling rates. This comparison can also be used for other subject matter, covered in different chapters and courses.

2. LITERATURE REVIEW

2.1. Learning of Environmental Topics and Recycling

As the importance of environmental issues started to be understood more critically, global and regional efforts increased, and education was no exception. To this extent, for the recycling theme, the rates and factors affecting the rates of recycling form the basis of the studies undertaken in the literature. Understanding the factors that affect the learning of environmental topics reveals various lines of data for enhancing the current structure of environmental education with regards to recycling.

2.1.1. Efforts on the Teaching of Environmental Topics and Recycling

Environmental education has been evolving for more than 40 years. It was put under the spotlight in 1972, when the UN Conference in Stockholm recommended the UN to establish an international environmental education program. UNESCO followed the recommendation by sponsoring a series of environmental education workshops and conferences around the world. In 1975, representatives of nations met in Belgrade, to outline the basic definition and goals for environmental education. In 1977, 60 nations met in Tbilisi for a follow-up. The two conferences established the definition of environmental education as; "a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and has the knowledge, attitude, skills, motivation, and commitment to work individually and collectively toward solutions of current problems and prevention of new ones" (Braus and Wood, 1993).

There are various approaches to enhance environmental awareness, and it is hard to determine which approach can better develop cognitive and attitude changes for a particular topic (Madruga and Silveira, 2003). To this extent, researchers are concerned with new concepts in developing learning systems and instructional materials (Uzunboylu et al., 2009). Design and development of various scenarios have the objective of helping to understand contemporary global issues and how they are interlinked (Macris and Georgakellos, 2006).

In this regard, efforts on recycling focus on different aspects of the theme. While some focus on a particular material, or on a particular area of a certain city, others examine the settings and groups for which the information is disseminated. There are also more hands-on or innovative studies, which are interlinked with different professions, like those on architectural or ecomical aspects of recycling. Some of the noteworthy works on recycling and waste management can be listed as: "Newark Recycling Program”, saving an area with inadequate waste disposal capacity from a crisis by community education; “School Can Program” promoting aluminium recycling by providing technical and educational assistance, along with supplying collectables; “Waste Watch”, increasing the awareness of both children and their families by orienting the 3R message from school to homes; “Recycling Roadshow”, increasing the rates around 25%, by bringing the recycling service and 3R message through a door-to-door strategy; “Lestari Program”, increasing the awareness of both students and the campus community, by setting the goal of a zero-waste campus via co-curricular activities; "Missouri Clear Program", reducing the expenditures of schools on chemicals and laboratory equipment, by working with schools; “The Eco-Literacy School”, attracting individuals by turning waste into educational space with professional architects; and "Avdan Recycling Museum", increasing the awareness of the target group by having been constructed next to a recycling area (Sudol and Zach, 1991; Grodzinska and Bartosiewicz, 2001; Maddox et al., 2011; Read, 1999; Zain et al., 2011; Giles, 2010; Kong et al., 2011; Yücel, 2015).

There are also examples at the institutional levels, like Cornwall Council – UK, Earth Day – Canada, and Çevko – Turkey, which are NGOs that work multidimensionally, by continuously publishing materials and organizing on-site activities. Recycling also serves as a profit basis for companies, as in Hollywood productions or the toy-sector, which use the concept for a target group of interest, also contributing to their education (Appendix B).

2.1.2. Recycling Rates

Although success of recycling programs is bound to the cumulative effects of social, economic and political factors, performance rates are the indicators in determining the accomplishment of objectives. Studies around the world that point out low recycling rates and other weaknesses in efforts show the consistent need for improvement in this area.

For instance, Clarke and Maantay (2006) show that although the residents of New York City know the requirements of their recycling program, rates average only around 20%. Likewise, Perrin and Barton (2001) point out that 90% of households in the UK claim to recycle, yet the national rate remains around at 9%. Mahmud and Osman (2010) state that although the recycling program in Malaysia was initiated in 1993 with the objective of extensive implementation, the recycling rate remains at only 5%.

In 1990, the UK Government introduced a target of recycling 50% of household waste by the end of the decade. However, Read (1999) pointed out that traditional approaches such as leaflet drops and newspaper adverts remained inadequate to achieve that goal. Similarly, in the US, Shapek (1993) stated that a significant sum of money was spent on the education programs with little or no measurement of the effects or results, pointing out that gaps in the advertising media choices also affected the rates.

At the institutional level, schools are important both for the quantity of waste produced and collected, and shaping the relevant attitudes. A campus-waste characterization by Smyth et al. (2010) in a Canadian university showed that between 1.2 and 2.2 metric tonnes of waste was produced per week, of which more than 70% could have been reduced or recycled. The study also notes that paper products, disposable drink containers, and compostable organics were the most significant items for targeted efforts in this regard.

The studies by DeYoung (1990), Kaplowitz et al. (2009), and Prestin and Pearce (2010) suggest that efforts should focus on messages concerning what, how, and where to recycle, in parallel with consistent and accessible infrastructure in the schools and the cities. In addition, Kildahl and Lam (2013) note that recycling efforts can be insufficient for various reasons, including the waste collectors focusing on particular types of wastes, as seen in the case of plastic recyclables in Hong Kong University. Nonetheless, Thomas (2001) points out that while participation is obviously critical, it is not just about how many people get involved; but how well they do so that is also crucial. The study emphasizes that providing informative feedback increases the rates by about four times, showing the importance of the action-reaction principle.

2.1.3. Factors Affecting Recycling Rates

Understanding the factors affecting recycling performance is key to achieving efficient waste management. The factors vary widely, and include income level, family size, pricing of waste disposal, level of education, type of recycling scheme, and satisfaction. Clarke and Maantay (2006) emphasized that family type, income and educational levels are correlated with low rates in New York. A similar study by Bolaane (2006) stated that limited knowledge and economic motives, and absence of visible centres limit participation in Botswana. In Mexico, Verdugo (2003) grouped the effective factors as socioeconomicals (age, gender, income, education level), physicals (household size, availability of services, storing space, communication media), and psychologicals (environmental beliefs, knowledge, conservation motives). In Sweden, Hage, Söderholm, and Berglund (2009), also note that both economic and moral motives, and specifically, distance of bins from the houses affect the rates. The study of Andrews et al. (2013), on the visuality of recycling bins in the US, showed that bins without a garbage bin nearby are used less frequently, and change in signage did not increase the rates by itself. Likewise, Perrin and Barton (2001) in the UK state that convenience of the scheme type and design, type of the material being recycled, and the level of change required for existing behaviours affect the rates.

Chen and Chang (2010) point out that rates of recycling in Taiwan were linked to two factors; exchange of information between people with regards to recyling, their experience with the recycling service provider, as well as the general environmental legislation of the country, which seems to have a positive impact on both. In Korea, Lee and Paik (2011) note that use of a volume-based waste fee system increased the rates, while age and income also had an effect. A similar work of Wang et al. (2011) in China showed that convenience of recycling facilities and service, residential conditions, recycling habit, and economic benefits are the primary determinants of behavior. The study of Sidique et al. (2010) in the US also notes that a pricing system with higher waste disposal charges would incentivize households to recycle more.

In Spain, Meneses (2010) noted that recycling behavior depends on both emotional and cognitive characteristics of individuals, but is associated more with positive emotions. The study of Saphores et al. (2012), in the US, also pointed out that the most important variable is moral norms, followed by convenience. In Germany, Matthies et al. (2012) showed the influence of parents on the behaviour of children, and indicated that especially re-use of paper is mainly influenced by communication. On the other hand, Maddox et al. (2011), in the UK, outline the effect of school-based education at the household level, where school children take the “reduce, reuse and recycle message” home to their families and engage them in sustainable waste management practices.

In Norway, a campus study by Klöckner and Oppedal (2011) showed that rates were affected by the type of recycling scheme, distance to containers, and transport mode used to reach them. Another campus study in New Zealand by Kelly et al. (2006) suggested having better signage in more appropriate places, and extension of the recycling scheme across a wider area. In the US, Pike et al. (2003) developed a recycling course at student apartments, and showed that the course did not increase the rates, unless students received bins. In Hong Kong, Kildahl and Lam (2013) noted that the rates for metal wastes increased 3.5 times in one year with adequate distribution of the bins around the campus. In Thailand, Suttibak and Nitivattananon (2008) stated that the common factors affecting the rates were awareness of the officials and source separation, both at the school and the community levels.

2.1.4. Factors that Affect Learning of Environmental Topics

When curricular efforts on recycling and other environmental topics are examined, we see a variety of efforts at providing quality in education. To help these efforts become instrumental in achieving the desired goals, various studies were conducted, which took different topics, instructional materials, and designs into account. These studies presented findings and suggestions on design and implementation, mainly emphasizing the importance of the academic background of learners, their former knowledge and skills, material type and design, learning environment, and learner-material-environment consistency, some of which are given below.

Academic backgrounds were taken into account in the study of Pace (2005), where a can crusher design was used to investigate the learning success of science-based and arts-based freshman students. The analysis identified polarisation of strategies within the groups, which was used to develop a methodology that overcomes some background limitations. A similar disparity, but in the course characteristics, was emphasized by Doyle (2005), noting that teaching a new course requires a foundational knowledge base and thinking skills of the learners, as can be seen in environmental hydrometallurgy.

Importance of observation was noted by Önal and Kızılçaoğlu (2011), who showed that visiting a landfill site, as a part of a waste and recycling course brings significant differences between pre- and post- comprehension and attitudes. In a similar vein, the work of Carolan (2007) noted that exchange of knowledge in a more hands-on, non-representational manner helps to form a greater sense of bonding with the environment, and leads to longer-lasting attitudinal changes. In addition, various studies show that software can also have positive and diverse effects on learning environmental themes. A virtual interactive representation of an industrial paper company, used by Eckelman et al. (2011) in an environmental management course, showed that the software led to higher increases in comprehension, communication, and expression of learners, compared to spending time in real world locations. The effect of the location where software was utilized was studied by Chang et al. (2011), for recycling, where using an instructional website tool outdoors had a greater effect, compared to using it indoors or in traditional instruction. Similar comparisons can also be found for various themes that are inter-related with the environment. The study of Silk et al. (2008) on comparing a computer game, a website, and a booklet on nutrition literacy for a natural diet noted that the website was the best for comprehension, as expected because of the general preference for knowledge acquisation today. Similarly, instructional arrangement for software was investigated, as done in the study of Pifarré and Li (2012) on a wiki embedded science project on setting up a colony on Mars, which shows that such inclusion can be effective only if the characteristics of the website are aligned with the content and the freedom of learners.

2.1.5. Methodology of Teaching Environmental Concepts and Recycling

The methodology of teaching environmental concepts is not completely new. Many of the methods used are similar to those used in other areas. Since objectives of environmental education demand viable learning outcomes, selected methods and techniques have to be active and participatory, providing maximum involvement of learners with experiences, actual or represented. Shortly, being true for many other areas, active and varied approaches are necessary in environmental education (Kinghorn, 2002).

Though various methods can be used to teach the same concept, some can be better than others, based on the topic and the group. Some of the methods used for teaching environmental subjects can be listed as field visits, situation analyses, role playing, games, surveys, projects, question-answers, and debates. In addition, environmental topics can be easily integrated into many course subjects, such as natural sciences, social sciences, health, history, economics, literature, arts, mathematics, and physical education.

However, it should also be noted that environmental problems often arise at the level of the individual. Although it is important for learners to understand international, national, and regional nature of the problems, programs which help them control their own actions, can be noted as the most effective (Braus and Wood, 1993).

2.2. Traditional and Computer-based Instruction

Numerous designs can be formed for the instruction of a particular subject, which can lead to significant differences in the achievement of goals. Yet, as various parameters are involved in creating a well-structured design, the research processes can become complex. One of the ways to cope with such complex problems is the analytical approach. This approach can be defined as focusing on particular pieces of indicative data on the parameters which are expected to have effect on the structure of an issue (Marzano et al. 2001). The content, order of sub-topics, lecture periods, and methods and techniques are some of the variables which can be examined in the analytic approach, for obtaining optimum practical output from the instructional processes. In this context, this study tests and compares the two designs, traditional and computer-based instructions, in terms of comprehension and attitude change they derive, with the objective to increase participation in recycling and improve recycling rates.

2.2.1. Traditional Instruction

Traditional instruction is an instructor-led process where the instructor presents the content, and guides learners through scheduled lectures in common locations such as schools or institutes (Fraser, 2015; Bedi, 2011; Wheldall and Glynn, 1989; Arends, 1997; Ashman and Conway, 1993; Jones, 1987; Gronlund, 1970). Although new approaches emerge over time, traditional instruction still has a wide acceptance as the best option to learn new knowledge and skills. Combination of presentation, demonstration, practice, and interactivity makes this type of learning the most powerful option for learners who want to participate in actual activities managed by a real instructor, with the chance of direct contact.

2.2.2. Computer-Based Instruction

Computer-based instruction is the computer or network-enabled transfer of knowledge and skills to learners (Roebuck, 2012; Berg, 2003; Alessi and Trollip, 1991; Clarebout and Elen, 2006; Dijkstra et al. 1992). It uses the advantage of the interactive elements of computers and computer software, along with their usefulness for presenting different kinds of media. The most recognized feature of this type of learning is its potential to help the learner study without personal assistance. Content is delivered via CDs, or the internet, which can also provide e-communication (Muljadi, 2011; Roebuck, 2012). Instead of limiting learners to attend courses at fixed times and places, it enables studying according to personal preferences, which also can lead to saving time. In addition, learners who have prior knowledge of a topic can skip sections that they are familiar with or have learnt before. Softwares also stand as good alternatives to printed materials since rich media can easily be embedded to enhance learning. Another advantage is that they can easily be distributed to a wide number of learners at a relatively low cost, once the initial development is completed. In addition, computer-based designs can be extra beneficial for learners with special-needs, who might not have easy access to classrooms.

2.2.3. Comparison of Traditional and Computer-Based Instruction

It is assumed that, under appropriate instructional conditions, all learners can learn most of the content that they are taught (Block and Anderson, 1975). However, different kind of instructional designs can be used to attain different goals, and these can have strengths and weaknesses when compared to one another, as also is the case with traditional and computer-based instruction (Table 1).

Table 1. Strengths and Weaknesses of Traditional and Computer-based Instructions.

Strengths of Traditional Instruction	**Strengths of Computer-Based Instruction**
• offers more multi-sensory structure • direct access to the instructor and students • generating relations and friendships	• studying at home or at any other place • no need for home-school transport • personal schedule
Weaknesses of Traditional Instruction	**Weaknesses of Computer-Based Instruction**
• fixed time and location limit the flexibility • necessity to be in class to keep up • lack of equality due to educational quality • generally less structured compared to software	• restricted to software programs • requires more self-organization • limited personal interaction • methods do not change during instructions

As shown in the table, both approaches have notable strengths and weaknesses. While traditional instruction offers more multi-sensory structure with direct communication, computer-based instruction offers more flexibility and individuality. However, in contrast to traditional instruction, computer-based instruction is restricted to software programs, requires more self-discipline, time management, and motivation, and has limited personal interaction. Moreover, in computer-based instruction, the methods cannot be adjusted according to need during the learning process. On the other hand, in contrast to computer-based instruction, traditional instruction restricts learners by requiring them to follow a set schedule and not allowing them to organize the timing of their activities according to their own preferences. Lack of equality in education due to the differences in instructor quality and opportunities are other disparities in this comparison.

2.2.4. Comparative Studies on the Two Approaches

There are many studies that evaluate the pros and cons of traditional instructional designs with their computer-based versions, some of which are given below. These studies suggest that either, or sometimes both, can be selected for the instruction of a particular topic. Due to the strengths and weaknesses of different instructional methods for a topic, the achievement and satisfaction of the learners can vary. Studies that evaluate a wide range of areas, from medicine to statistics, show that traditional instruction, or its computer-based version can prove to be more effective, depending on the subject matter.

A comparative study on the multiplication concept in the program of 3rd graders in a primary school pointed out that achievement scores of the group using software were significantly higher than the control group getting traditional instruction (Taleb and Hassanzadeh, 2015). Another study on the multiplication, division, and fraction unit also revealed a positive difference in favor of the computer-based instruction, excluding the fraction concept (Pilli and Aksu, 2013). A similar study on the substances theme for the same age group resulted in favor of computer-aided instruction, but the effect was not permanent (Köse, 2009). Another study on the subject of geography compared a software game with a traditional game; the findings did not show any significant difference between the groups, although the participants preferred the software game over the traditional one (Furió et al., 2013). In line with that design, the study integrating a computer game into a high school lecture on training dogs showed that the game also made a difference in the retention of the knowledge gained (Brom et al., 2011). A study on the secondary school biology course also showed that the effect of computer-based instruction on performance was higher than its traditional counterpart (Yusuf and Avolabi 2010). The comparative study for basic computer competency in primary schools noted that higher scores obtained by the computer-based groups were a result of more efficient and enhanced use of time, inherent to the relevant learning environment (Rule et al., 2002). Another study on a computer programming course showed that the cognitive gain of the computer-based group was greater, but the skill outputs did not differ between the two (Kausar et al., 2008).

On the other hand, a comparative study on cardiopulmonary resuscitation showed that the computer-based instruction was as effective as its traditional counterpart on knowledge outcomes, but not in terms of practice, which is critical (Rehberg et al., 2009). Likewise, in a study on an electrical circuits course, the traditional group was seen to get higher learning scores on theoretical topics, but not in those that required hands-on skills (Mills, 2001). A similar study on an undergraduate pharmacology course noted higher scores in favor of the traditional group regarding overall satisfaction, though not in exam scores (Hale et al., 2009). In another study, on a social work research course, the findings indicated no differences between the eight of eleven performance and ten of thirteen satisfaction outcomes that were tested for, though the remaining were in favor of the traditional group (Westhuis et al., 2006).

A comparative study on a human rights course showed that both designs brought improvements, without a significant difference (Tardiff-Williams et al., 2007). Another study conducted in a nursing class for a short learning module of thirty minutes also showed that there were no significant differences in learning outcomes between the tested groups (Nelson, 2013). Comparison of the two designs for a graduate research methods course noted that the performance outcomes did not differ, but persistence was harder for the computer-based group (Ni, 2013). A study on a chemical safety course also showed that the outputs were equivalent regardless of the mode of instruction and learner characteristics had no impact on the results (Withers et al., 2012). Another study on an engineering drawing course also indicated that both groups showed similar learning outcomes for comprehension (Szeto, 2014). The study on a cardiopulmonary resuscitation course found no differences in the comprehension, but higher satisfaction in the computer-based group, noting that the mean time for the group to complete the program was 2.5 times lower than its counterpart (Hemmati et al., 2013).

Findings which may seem counterintuitive also exist in the literature. A study on a basic statistics course noted that while the knowledge increase of the computer-based group was greater, skill increase was in favor of the traditional group (Ragasa, 2008). Another study on a nursing course comparing the three modes; traditional learning, distance learning with face-to-face contact, and distance learning with no contact, noted that the distance learning groups obtained higher results (Duffy et al., 2002). The comparison in an English course noted that learners receiving computer-based instruction performed better, and blended instructions increased the duration for learning (Al-Hassan, 2010). In this context, when details of various studies as above are considered, the following patterns seem to emerge:

- Instructional designs should be checked individually for every single topic; the results may differ from the expectations.
- Comprehension and practice outputs can be favored by different instructional designs.
- While some designs may seem more effective, the differences may be impermanent.
- The preference or satisfaction of learners may differ from their performance output.
- In general, learners using computers can have higher satisfaction, which mainly arises from efficient time use and lower satisfaction, mainly due to lack of communication.
- Instructional methods that lack practical or hands-on components can be problematic in applied fields such as in chemical safety or electric circuit setups, and may even have life-and-death consequences, for instance, like in CPR training for emergency responders.

3. METHODOLOGY

3.1. Framework of the Study

In determining the difference between the effects of traditional and computer-based designs on the recycling theme, with an equal instructional content, achievement of the two groups of learners who received these two different type of instruction were compared. The study was carried on through a pretest-posttest experimental design (Karasar, 2005), and the findings aim to note the difference in the comprehension and attitude test scores of the learners.

The instructional content covers the importance of recycling, distinction between re-usable and non-usable wastes, proper disposal of wastes according to the characteristics of the collection system, and the following treatment processes. Comprehension and attitude tests were applied, before and after the instructional period, with time-lags in between to see the permenance of the effect of the two instructional designs on the learners. All parts of the experimental design was applied synchronously in weekly basis in the school. The schematic display of the timetable applied for both designs is shown below, in Table 2.

Table 2. Schedule of the Experimental Design Applied on Both Groups.

Placement of the Bins in the Classrooms	Pre-tests		Instructional Period	Post-tets	
	Comprehension Test	Attitude Test		Comprehension Test	Attitude Test
Week 1	Week 5		Week 6	Week 9	

Following the schedule, the recycling bins were distributed to the classrooms on 11 April 2014, leaving the students a month to get used to the change. Following this, in the week of May 12th to May 16th, comprehension and attitude pre-tests were applied to all students. The instructional period, May 20th to May 23rd, was again followed by a two-week gap for the retention, and the post-tests were applied in the week of June 9th to June 12th.

3.2. Research Questions

The research questions are designed upon the hypotheses of the equivalence of the effect of the two instructional designs on cognitive and attitudinal level of the learners. As a baseline expectation, the initial knowledge and attitude of the learners were analysed for the equivalency of the treatment groups. This was performed by comparing the pre-test findings of the two groups (see sections 4.1.1 and 4.1.2). In addition, to get a substantive answer to the research questions, the effect of treatments on the two groups were analysed individually for each group in advance. This was performed by comparing the pre- and post-test findings of the groups (see sections 4.1.3, 4.1.4, 4.1.5, and 4.1.6). After the confirmation of the equvalency of the groups and significant increase in the cognitive and attitudinal level of the learners, the two research questions are stated as:

I. “Is there any significant difference between the Recycling Comprehension post-Test scores of the learners who received the traditional and computer-based instructions?”

This question is analysed by testing the hypothesis: There is not any significant difference between the Recycling Comprehension post-Test scores of the learners who received the traditional and computer-based instructions (see section 4.2.1).

II. “Is there any significant difference between the Recycling Attitude post-Assessment results of the learners who received the traditional and computer-based instructions?”

This question is analysed by testing the hypothesis: There is not any significant difference between the Recycling Attitude post-Assessment results of the learners who received the traditional and computer-based instructions (see section 4.2.2).

3.3. Study Group

The field study was undertaken in the 2nd term of the 2013-2014 academic year at a primary school in İstanbul, with four sections at the 3rd grade level. The decision on the level of the group was made based on four criteria: timing of the presentation of the subject, cognitive aptitude of learners, feasibility of implementation, and novelty of the subject for the group.

For the first criterion, given that the study is on learning one of the basic topics of environmental protection, it was decided to focus on children. As noted in part 1.1.1, environmental protection is a way of caring for the environment, at the individual or societal level, for the benefit of nature and humans, which requires an understanding that has an educational basis, starting from elementary stages. In this context, recycling stands out as an important topic of environmental protection that must be learnt from early childhood onwards.

For the second criterion, existence of cognitive competence to be able to understand a particular topic was considered. The approved notion in the cognitive development theory states that children aged around seven to twelve go through the concrete operational stage (Erden and Akman, 2001). In this period, the thought processes become more rational and mature, leading to the ability to develop logical thoughts about objects and rules. Before the beginning of this stage, the ideas of children about objects are dominated by appearance, however during this stage they develop the understanding of conservation and reversibility, as in the stability of the amount of a liquid when passed to different shaped containers. In addition, for the purposes of this study, the requirements of reading, writing, and the ability to use computers led to the elimination of first graders.

A third criterion was the convenience of the sampling method, for practical reasons. The school was selected considering familiarity and location, along with additional factors such as acquaintance with the management, layout plan of the building, and ease of transport. Due to random distribution of students into sections at the beginning of the academic years, the groups were expected to have no distinct differences. Nevertheless, pre-tests were used to test this notion, and the groups were found to be identical, see section 4.1.1 and 4.1.2 below.

The final criterion was on the notion that learners should have not covered the topic before. The topic is introduced in the Life Sciences course of the 3rd grades, which set the upper limit of the study to the end of the 3rd academic year. In addition, regarding the choice of MEB on the placement of the topic in the curriculum, 3rd graders were determined as the study group, and it was made sure that the teachers did not go through the topic in advance.

Hence, taking all these factors into account, 3rd grade students at a primary school at the Beşiktaş district of Istanbul were determined as the sample group for the study. At the very beginning of the study, due to the differences in seating plan and the media used in their lectures, Section E was excluded from the study. Sections were randomly assigned to each design, due to results of the comprehension pre-test, which showed no significant differences between them. On the other hand, according to the findings of the attitude pre-test, it was noted that selecting the sections A and C for one group, and B and D for the other was better for bringing the initial mean points closer to each other. Therefore, the sections were randomly set as A and C for representing the traditional group, B and D for representing the computer-based group. The groups contained similar numbers of students both in total and in terms of gender distribution as follows: Section A with 17 girls and 18 boys, Section B with 17 girls and 17 boys, Section C with 19 girls and 16 boys, and Section D with 18 girls and 17 boys. The request by the Ministry of Education Research Unit to not record the names of the students was followed throughout the study.

3.4. Content and Instructional Process

This study covers the same content on recycling in two completly different settings: in classroom and on computers. It is based on direct instruction, which aims to promote learning of well-structured procedural and declarative knowledge and skills that can be taught in a step-by-step fashion (Arends, 1997). The instruction was constructed on the basics of recycling, where paper, plastic, metal, and glass wastes were the focus. The topic was covered with the sub-topics:

- Reusable wastes, recyclable wastes, and garbage.
- Quantity of waste produced and decomposition times.
- General characteristics of the recycling system.
- Importance of reducing, reusing, and recycling.
- Waste treatment processes and their comparisons.

3.4.1. Theoretical Background of the Instruction

An instruction can be designed to be used in a classroom under the control of a teacher, or without direct teacher supervision. Likewise, it can be designed for a single learner working alone or for groups of learners. It can also be styled to provide direct teaching of knowledge or skills, or discovery (Arends, 1997; Jones, 1987; Gronlund, 1970). In this study, both designs are in the form of direct teaching, differing in terms of the first two options.

There are three main approaches in instructional designing, namely; subject-centered, learner-centered, and problem-centered (Demirel, 2006). The subject-centered design is the most widely used in educational applications, and can be found in four main types; subject, single discipline, interdisciplinary, or process-based. Among these, interdisciplinary design is used to pool different subjects together in a meaningful manner, and is employed in the national curriculum of primary education for the topics; the human body, communication, history, sanitation, geology, disasters, traffic, natural resources, energy, the family, living organisms, safety, money, and commemoration. These topics are present at the "Life Studies" course in the first three years, in which the recycling theme is embedded within. Accordingly, the plan of the study is constructed within the scope of MEB.

Likewise, there are three main approaches in setting goals for a lecture; stepwise, qualificational, and modular (Demirel, 2006). The first of these takes Bloom's Taxonomy into account, emphasizing the levels of learning according to their complexity, the second deals with the standards to which the learner is expected to achieve at the end of the program, and the third is for the non-gradual units or sections. Consequently, this study concerns modular goal setting, according to the sub-sections of the subject.

There are numerous instructional techniques that are used in lectures, individually or collectively. Although a lecture cannot be carried out with a single technique, the question-answer technique was dominant in the instruction developed for this study.

Though the selection of models, strategies, and techniques are important in a design, it should be noted that this study does not test any of them explicitly. The study compares two designs set up for two exactly different learning environments in their broadest sense.

3.4.2. Instructional Components Used in the Study

Various components can be noted as necessary in the construction of an effective instruction (Alessi and Trollip, 1991; Arends, 1997; Ashman and Conway, 1993; Jones, 1987; Gronlund, 1970; Berg, 2003; Block and Anderson, 1975; Dijkstra et al., 1992; Clarebout and Elen, 2006). When the main designs in the educational programs on recycling are considered, almost all are seen to possess a very similar instructional structure, based on the types of recyclable materials, e.g. papers, plastics, metals, and glasses, while some differ in including organics, composites, or batteries. The components considered in developing the instruction in this study and their uses within the scope of this study are listed below.

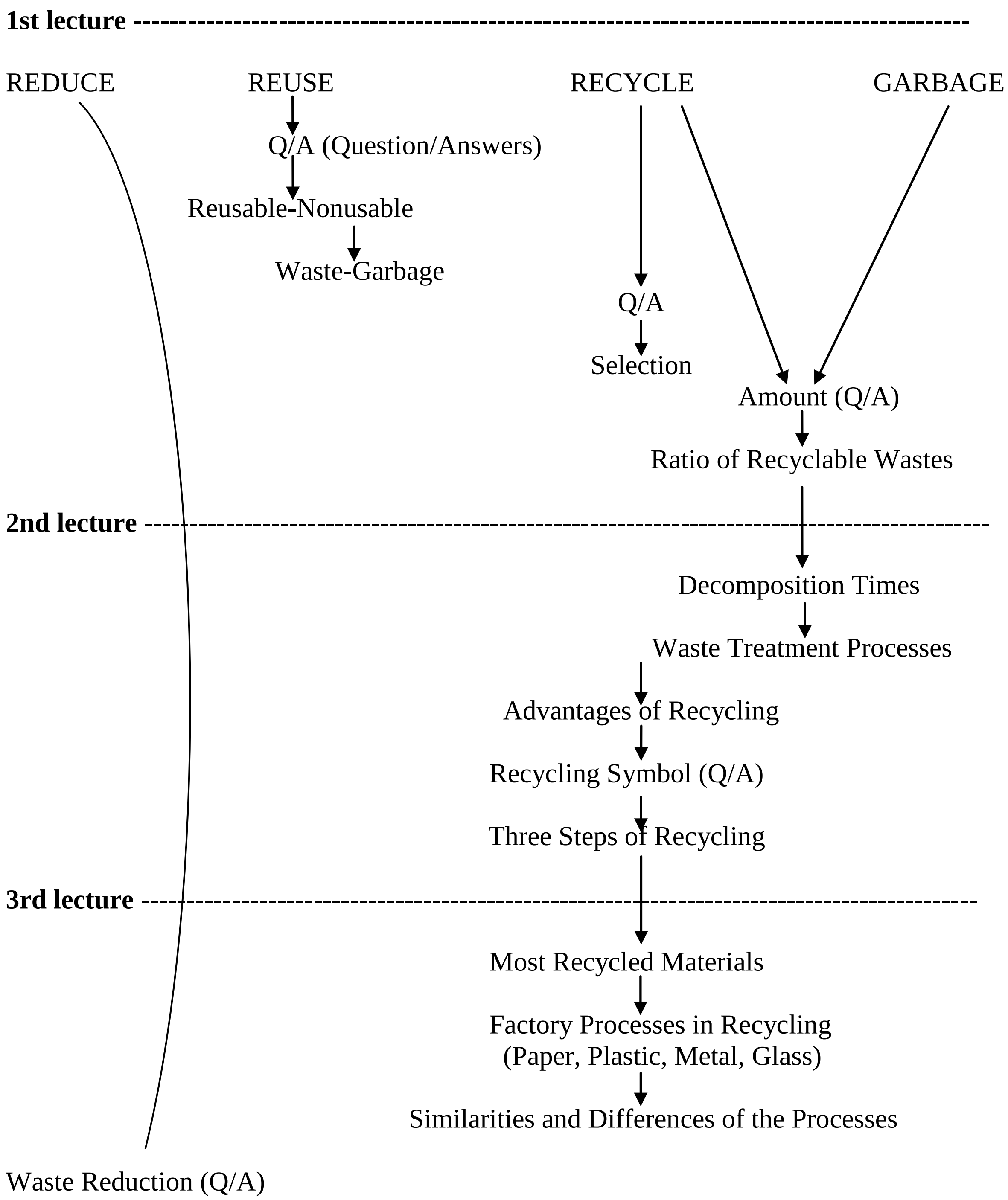
- Prior knowledge: Waste management and recycling are themes from our daily lives. In this perspective, prior knowledge of students is relevant in all question-answer sections of the lectures. The visuals are aimed at serving as reminders.
- Organizing knowledge: The sub-topics are spontaneously connected with each other so that learners will not need to put in an effort to connect the different topics with each other. Thus, all the content was organized in an easy to follow manner.
- Motivation: Students were informed about what they will learn, its importance, and its applicability. The intention was to make them feel that they were supported, and that they would be able to reach the course objectives. Moreover, ways to foster interest were added to the instruction by incorporating novel examples and questions.
- Integration of theory with practice: Due to its content, the instruction spontaneously connects the theory with goal-directed practice on reduction, reuse, and recycling of wastes. It directly points out relevant attitudes to achieve the objectives of recycling.
- Feedback: Througout the instruction, feedback is given to students both in question-answer format. This was done to encourage the learners to observe, assess, and adjust their own progress.
- Interactivity: The instruction possesses a style where the instructor/software is always in a dialogue with the learner, including hands-on activities. In the lectures, learners were directed to be active participants rather than being passive recipients.
- Connecting to reality: Due to its nature, all the content is automatically linked to real life, with regards to the theme of recycling. Thus, the knowledge and attitudes were connected to everyday contexts meaningfully.
- Reducing cognitive load: Cognitive load may be seen as the level of mental energy required to process a given amount of information. By making the content as simple as possible, dividing information into sections, and focusing only on the content, redundant cognitive load was aimed to be reduced.
- Contests: As contests increase motivation and engagement with the lesson, the study included a contest on filling several speech balloons.
- Comics: Similarly, comics also increase engagement with the subject, and the activity of speech balloon filling was made on selected comics on recycling.
- Games: Two games were included in the study, the recycling factory game and the speech balloon filling game, both aiming to increase interest and enjoyment.
- Special animated character: A young character with common physical characteristics of the population was composed and used in the recycling factory game where the learners' aim was to guide him on his mission.

In addition, field trips, group activities, videos, and various other components can be integrated in such a instruction. However, in order to keep the equivalency of the experimental design within the groups and not to extend the application period these components were not used in the study.

For both study groups, content and form were determined by three experts; a primary school teacher, an expert on computational and instructional technology, and an expert on curriculum and instruction. Materials for the study were also prepared by the graduates, and mainly contained original scripts and visuals, with additions from several web sites, obtained via written permissions. The content was based on fundamental steps, stating appropriate instructional objectives and specific learning outcomes and relating these to the designs, along with considering the objectives in test preparation.

The two designs for the traditional and computer-based groups were equivalent in terms of content. It was spread over four lecture hours, as determined in the pilot lecture and comprehension test applications.

The flowchart and lesson plans of the two instructional designs are given in Figure 1 and Table 3. In addition, the line up of the pages in computer-based instruction, presenting the same bits of information with the traditional design in the study, is given below in Table 4, with the corresponding pages provided in Appendix C.



"Filling of the Speech Balloons"

4th lecture -----------------> **"**Recycling Factory Game"

Figure 1. Flowchart of the Instruction.

Table 3. Lesson Plans of the Instruction.
Name of the Course: Life Studies
Grade: 3
Chapter: Yesterday-Today-Tomorrow
Period: 40 minutes x 4
Subject: Recycling of Solid Wastes

<u>1st lecture</u>

Objectives:
Students will be able to;

Differentiate between reusable and non-reusable wastes,
Differentiate between waste and garbage,
Define the recycling cocept,
Give examples to recyclable wastes,
Discuss how much waste is produced by a population,
Define the ratio of recyclable wastes in garbage.

Content:

1- The first lecture starts with waste-related pictures and relevant questions. The pictures are of;
    - a- Several types of wastes and people throwing these into waste bins.
    - b- A garbage truck with its seperate section for recyclable wastes.
    - c- Used juice box
    - d- Used glass bottle
    - e- Used paper
    - f- Used storybook
2- This is followed by presenting three choices for personal wastes; reusing, recycling, and throwing the waste to garbage.
3- The presentation goes on with the first title "reuse" with a similar question format by asking of items that can be reused, but this time without a clue picture.
4- Next, some examples of reusing are presented with pictures;
    - a- Used jars
    - b- Used books
    - c- Used clothes
5- Passing from reusables to non-reusables is done through the distinction between broken and unbroken glasses for drinking.
6- Next, for non-reusables; the waste-garbage discrimination is made again in a question-answer format, by asking about the difference between waste and garbage.
7- Next, two inverse schematic displays are presented, and students are asked whether wastes involve garbage, or vice-versa.
8- Next, introduction to recycling concept and items that can be recycled are delivered through a basic question-answer format, with the following questions:
    - a- Do you know what "recycling" means?
    - b- Can you give examples of recyclable items?

9- At the next step, the title “garbage” is included in the context, by covering the amount of waste that is produced in a house, a city, and by a person, again with a similar question-answer format, based on predictions of students.
10- Finally, the ratio of recyclable waste in total waste is covered with a question-answer format, based on predictions of students.

<u>2nd Lecture</u>

Objectives:
Students will be able to:

Discuss decomposition times of wastes based on their raw material,
Discuss general waste treatment processes,
Differentiate the treatment processes between recyclable wastes and and garbage,
Recognize the recycling symbol,
Discuss the origins of recycling symbol,
Define the three steps of recycling.

Content:

1- The second lecture starts with presenting decomposition times of wastes according to their material type, for an introduction to the importance of recycling. This is done by in a question-answer format, through the examples of a:
    a- Used can,
    b- Used jar.
2- Next, the pollution from several durable wastes and the harm of their decomposition is presented, taking the soil, water, and air into account.
3- Next, basics of waste treatment processes is presented by mentioning:
    a- Landfill,
    b- Incineration,
    c- Recycling,
    d- Composting.
4- The lecture carries on with the differences between waste treatment processes of recyclable wastes and garbage, to show the advantages of recycling.
5- At the next step, cumulative advantages of recycling is stated according to:
    a- natural resource protection,
    b- energy saving,
    c- waste reduction,
    d- decreasing of environmental pollution.
6- Next, students are asked to shortly write down the cumulative advantages of recycling, as in the previous section, under four titles.
7- Next, the recycling symbol is presented with question-answers, discussing its:
    a- Shape,
    b- Origin,
    c- Meaning.
8- Finally, the cycle of a particular recyclable waste is presented to visualize the three steps of the symbol.

3rd Lecture

Objectives:

Students will be able to:

List the steps of the recycling of paper,
List the steps of the recycling of plastic,
List the steps of the recycling of metal,
List the steps of the recycling of glass,
Differentiate similarities and differences of recycling processes,
Discuss the ways to reduce waste production.

Content:

1- The third lecture starts with mentioning of the materials that are recycled most, in a question-answer format.
2- Next, factory recycling processes of main recycled materials are shown by drawings, for:
    a- Papers,
    b- Plastics,
    c- Metals,
    d- Glass.
3- Next, to sum-up, the common practices for the different processes and their distinguishing features are given in a summary table.
4- Lastly, the ways to decrease the amount of waste before consumption, as in supermarket shopping, are highlighted, based on selecting the products according to:
    a- Packaging,
    b- Needs,
    c- Reusability,
    d- Recycability.

5- At the end of the lecture, students asked to fill out the blank speech balloons of four caricatures on the screen/on the worksheets (Appendix C).

4th Lecture

As notified to the students at the beginning of the study, the 'Recycling Factory Game' is introduced. In this activity, students were asked to help the animated character who starts working at a recycling factory. For the mission to be completed with the least number of errors, students are asked to command the character on the screen/*on the whiteboard* to help him take the right decisions in the process devices, throughout the tracks.

Table 4. Line Up of the Steps/Pages in the Instruction.
1- Introduction
2- Making comments on the pictures on wastes and waste bins
3- Thinking about a used juice box
4- Thinking about a finished storybook
5- Reuse-recycle-garbage classification
6- “Reuse” title
7- Thinking about a reusable item
8- Example on reuse of jars
9- Example on reuse of books
10- Example of reuse of clothes
11- Passing from reusables to non-reusables
12- Definitions of reusables and non-reusables
13- Non-reusable wastes: recyclables and garbage
14- Definition of wastes
15- Definition of garbage
16- Wastes minus garbage
17- Do wastes include garbage or is it vice versa?
18- Wastes include garbage
19- Definition of recycling
20- Thinking about recyclable items
21- Examples of recyclable items
22- Thinking about waste production in a house
23- Waste production of an individual
24- Waste porduced in a city
25- Thinking about the recyclable/waste rate
26- Recyclable/waste rate
27- Sample question on finding the amount of recyclable waste in a given amount of waste
28- Solution to the question above
29- Thinking about decomposition time of a can
30- Thinking decomposition time of a jar
31- Thinking about decomposition time of a cartoon box
32- Thinking about decomposition time of a plastic bottle
33- Wide range of decomposition times
34- Decomposition times based on the types of materials
35- Wastes and pollution
36- Air-land-water pollution
37- Wastes and animals
38- Introduction to waste processes
39- Four main processes
40- Landfill
41- Incineration
42- Recycling
43- Composting
44- Comparison of the processes
45- Determining the green processes
46- Pollutive processes
47- Harmless processes

48- Cumulative importance of recycling
49- Recycling and protection of resources
50- Recycling and energy conservation
51- Recycling and decreasing the amount of garbage
52- Recycling and decrease of pollution
53- Introduction to recycling symbol
54- Origins of the symbol
55- Gary Anderson, the designer of the recycling symbol
56- Thinking about the meaning of the symbol
57- Meaning of the symbol
58- Meaning of the three arrows
59- Visualization of the arrows
60- Introduction to paper-metal-plastic-glass recycling
61- Colored bins
62- Mixed bins
63- Use of recycling bins in classrooms
64- Introduction to factory processes
65- Recycling process for plastic products
66- Recycling process for paper products
67- Recycling process for metal products
68- Recycling process for glass products
69- Repeatedly recyclable materials
70- Introduction to similarities of the processes
71- Similarities of the processes
72- Question on the recycling of food wastes
73- Explanation about organic waste processing
74-Minimizing the waste production
75- Ways of minimizing waste production
76- Introduction to the caricature filling section
77- Caricature 1
78- Caricature 2
79- Caricature 3
80- Caricature 4
- Followed by the Interactive Recycling Factory Game (96 Scenes), given in Appendix D

In brief, the first lecture starts with waste-related pictures. This introduction is followed by questions on the attitudes of the learners on the common wastes they produce, in order to bring their attention to and lead the conversation to the recycling theme. As given in the appendices, the questions include some like “What do you do to an orange juice box when you are finished with the juice?” or “What would you do about a shirt that won’t fit you anymore”. Next, the correct behaviour is presented, by classifying sample materials as “reusable”, “recyclable”, and “garbage”. The presentation is continued with the first title, “reuse”, and the same question-answer format. Next, the distinction between “reusable” and “non-reusable” materials are stated. For non-reusable materials; the waste-garbage distinction is explained. Next, introduction to “recyclable” materials is again made via questions, leading to the definition of recycling and common recyclable materials. In the next step, the title “garbage” is included in the context of the lecture, by covering the amount of waste that is produced in a house and city, again in a question-answer format, based on the predictions of the students. At this point, information on the average ratio of recyclable waste to non-recyclables is provided to the students.

The “garbage” topic is covered in in the second lecture, with predictive questions on decomposition times of wastes based on their content, in order to emphasize the importance of recycling. This is followed by the “waste treatment processes” section, which covers the basics of landfill, incineration, and recycling, including composting. The lecture is continued with the differences between these processes, illustrating the advantages of recycling. Here, the advantages are stated under the categories of “protection of natural resources”, “energy saving”, “waste reduction”, and “decreasing environmental pollution”. At the end of the lecture, the recycling symbol is introduced, emphasizing its meaning and origins, leading to the three steps of recycling.

The third lecture starts with discussing the most recycled materials. Next, basics of factory recycling processes for paper, metal, plastic, and glass products are covered, in that order. This is followed by a presentation on the commonalities and distinctions of these processes. The lecture continues with an emphasis on consumer behavior for the reduction of wastes. In the final part, students are given cartoons with their speech balloons erased, and asked to fill them in as they wished, for their exhibition after the lectures.

In the last lecture, a young animated character is introduced to illustrate the practices on selection, collection, and processing of recyclable wastes. The character presents a general review of the basics of recycling for getting ready to work at a virtual recycling factory. In the factory, the learner commands the character to make the right decisions for carrying out various recycling processes, and tries to finish the tracks for the four types of recyclables with minimal error.

Both the traditional and the computer-based instructions were prepared to be parallel to each other. Throughout the lectures, same elements with potential to make the activities more attractive for students were used. These ranged from funny images to unexpected options in multiple choice tests. To sum up, the objectives and the content of the two instructions were identical, with the aim to have the post-test differences, if any, be due to implementation effects only.

3.4.3. The Design for the Traditional Instruction

For the traditional instruction, the factors which interact and form the classroom dynamics were carefully designed. These factors included learner, content, classroom setting and instructor components, shaping of the process and learning outcomes (Ashman and Conway, 1993). In the traditional instruction, the content and design of the direct instruction was formed the same way as in the computer-based instruction but with the instructor passing the information on instead of the software.

The parts that contain individual work of learners were also equated among the two designs in the study. In the cartoon filling part of the lectures in the traditional instruction, each learner is presented worksheets with four cartoons with their speech balloons erased, and were asked to fill them in as they wish. In the same manner, each learner in the computer-based instruction, were also asked to fill the same cartoons in on the screen. Both groups were told that some would be selected for putting up on the walls of classrooms, which was the case later on. Likewise, the interactive factory game was also implemented through the same visuals. While the learners in the traditional lectures commanded the character projected to the whiteboard by expressing their choices to the instructor in the classroom, the learners in the computer-based lectures did it by using the mouse of the computer, both trying to finish the recycling tracks step by step with minimal error.

In this fashion, the content was similarly covered in the two designs. All the steps of the instructor-learner interaction were concurrently run in the computer-learner interaction.

3.4.4. The Design for the Computer-based Instruction

The computer-based instruction and its materials were composed by following basic principles and elements of screen design. In its preparation, for the first three lectures, the pages were prepared on Microsoft Office Powerpoint. For the fourth lecture, which required richer visuals, the pages were prepared on Adobe Flash.

With respect to the basic principles, the software was constructed on the principles of simple design, simple language, consistency, renewability, recognition, and feedback. The design was kept simple and aesthetically appealing, in order to minimise information clutter, and make the task at hand understandable and enjoyable for students. Every item was made to be consistent with each other, and in line with the main subject of interest. In fact, this structure arose by itself from the components of the topic of recycling. Students were able to go back and correct their mistakes when they felt that it was necessary. In addition, the software was organized in a manner that did not encourage memorization, but rather, recognition through the use of a feedback structure. The materials were developed on the notion of “ease of use”, and individual assistance was provided in the instruction, whenever needed.

The elements of the screen design were also put together in a coherent manner. The software was compatible with the standard 800x600 screen ratio size of computers in the computer room. Visuals were surrounded with a white border, focusing attention onto the screen. No menus were used, in order to help simplify the context, however arrows placed at the right bottom corner of the screen helped to lead students to the previous and following pages. In the recycling game section of the instruction, icons representing shortcuts to recycling manuals on four material types were placed at the left bottom corner of the screen. While the main information was placed in a prime position on the pages, supplementary information was placed on the side sections. The context was divided into its components on multiple pages, rather than making more information available on one page. This directed students to move forward step by step, and saved them from scrolling down, and potentially getting disoriented in excessive information. Pop-ups were not used, so that the students would not feel the need to deal with them immediately, and get distracted. Instead, constant dialogue boxes were preferred, in parts where students were guided to stop and think for a moment, and illustrations accompanied the tutorials to make the presentations clearer.

3.4.5. Delivery of the Instructions

Exactly one month before the pre-tests, the recycle bins were placed, next to the garbage bins which were already present in the classroms. The recycling bins were emptied at regular intervals in order to keep the bins empty and potentially usable, and also check their content to record the most common materials released by students for the attitude tests. All stages of this preparation period were undertaken under the control of the author, visiting the school twice a week in the morning or afternoon, working with the staff outside of lecture hours. A special meeting was also held with the teachers of the four sections (A, B, C, and D), at the office of the principal before the study was undertaken. The study was introduced to the teachers and they were instructed not to provide any information to the students about it. Throughout the study, the teachers did not give any lectures about the topic of recycling and, when required, told students that the bins were provided by the municipality as a part of a routine recycling program.

The four sections were randomly divided into two groups; two for the traditional design, and two for the computer-based design. The study was introduced to the learners, noting that their participation was part of an independent academic research.

For the traditional lectures, classrooms were used. The classrooms contained a white board, a projector, benches and tables. The instructor effect was eliminated by having the same instructor, the author, teach each section. The instructor used the projector to present pictures, and the board for general explanations. Printouts were used for the cartoon fill-in, mentioned above. Learners were told that they were free to take notes and ask questions.

The computer room was set up for the computer-based lectures. The software was installed on the computers, and students were supervised to make sure that they were able to navigate the program by themselves. They were told that they were free to follow the lecture as they liked, could ask for help for any technical problem they might encounter, and should inform the instructor when they were done.

Both instructions were set in four 40-minute sessions on consecutive days, but especially for the learners in the computer-based instruction, finishing early or use of additional time was allowed. Thus, time was allowed to be a variable for the computer-based design. The two designs were developed simultaneously, in concordance with the previously determined content. Several revisions, accompanied with sample lectures, were made until the construct and flow of the designs were deemed to be satisfactory by the professional instructors. To keep the construct and flow of the two designs as consistent as possible, the traditional design mirrored the computer format, where the pages of the computer-based instruction were bound to be used as the lecture script.

3.5. Data Collection Tools

The study is undertaken with the aim of determining the difference in the cognitive and attitudinal outputs of students after the implementation of two equivalent instructions on recycling, which were identical in terms of content, but different in their design. In this context, comprehension and attitude tests on the topic were prepared. While pre-tests were applied before the instruction to determine initial knowledge and attitudes about the topic, post-tests were applied after a time lag following the lectures, to find out the actual change in learner comprehension and attitude.

3.5.1. The Recycling Comprehension Test

The aim of the comprehension test, presented in Appendix D, is to determine the levels of pre- and post- recycling knowledge of students. In this sense, principles of test construction were followed, which included harmony with the objectives, cover of the content, use of appropriate items, validity and reliability, and improvement of learning (Arends, 1997). Pilot tests assisted this process in the formation of the comprehension test, with the elimination of 38 questions, leading to the final form with 21 questions. Although computerized testing is common in computer-based designs, it was considered that introducing different testing methods could potentially bias results of the study, and hence were not used. The number of questions and their distribution on each sub-topic are presented below, in Table 5.

Table 5. Distribution of the Test Questions based on Sub-topics.

Topics	Question numbers
Distinction between re-usables, recyclables, and garbage	1 – 7 – 14 – 18
Waste amount and decomposition times	4 – 5 – 6 – 10 – 11
Characteristics of the recycling system	2 – 9 – 15 – 16 – 17
Importance of reducing, reusing, and recycling	13 – 20 – 21
Waste treatment processes and their comparison	3 – 8 – 12 – 19

The final form of the test was applied as a pre-test before the instruction. The pre-test was used for both determining initial knowledge of learners and the equavalency of the groups, as noted in section 3.5.2. Students were informed of their scores, but not individually about the questions, to prevent undocumented instruction. The information that the same test was going to be used as a post-test was not shared with the students. The post-test was applied following completion of the instruction. After the post-test, the students were informed of their score, and the answers were reviewed. The comparison of comprehension test scores were done through the independent samples t-test.

3.5.2. The Recycling Attitude Assessment

The attitude assessments were performed in special “craft sessions” in the classes. As done in the preparation of the comprehension test, general principles of observative assessments were followed together with expert contributions. In these assessment hours, the aim was to determine the difference in the proportion of materials collected in the recycling bins versus the garbage bins.

The craft hours were on preparing paper figures by using A4 sized colored paper, scissors, and glue (Appendix E). In the pre-assessment, the theme was “Fruits”, where each student was asked to prepare a fruit made of paper, using the provided materials. The theme for the post-assessment was “Summer”, where students were asked to represent the summer, using the same materials. Lectures were performed in the afternoon, before the last hour. Timing of the lectures allowed the contents of the bins to be quantified immediately after the craft session, so that it would be possible to correctly compare the amount of paper disposed of in the bins.

In the assessment, students were directed to release the left over papers at the end of the lecture, whereby they had to choose one of the two bins in the corner of the classroom: the garbage bin or the recycling bin. Attitude was determined by measuring the relative amount of paper released to the garbage and recycling bins, which was done by recording the ratio of the amount of paper in the recycling bins to the total amount of paper in both bins. The pre-assessment was used for both determining the former use of recycling bins and the attitudinal equavalency of the groups.

As mentioned in section 3.4.3., the instructional material of the study mainly covers the four main recyclable material types; paper, plastic, metal, and glass. Each of these categories ase covered equally in the lectures (see the flowchart and course plan in section 3.4.3., and the line up of the instruction in section 3.4.4.). In order to keep the design simple, only one of these materials –paper– was chosen to be used in the assessment. There are several reasons why paper was selected. First, paper recyclables were discarded in the highest amount in the classrooms, as also seen in the 1 month trial period. Paper is also safe to deal with compared to metals and glass. Moreover, it is easier to handle than other materials. In addition, when it is considered that the waste material generated in the assessment is produced in excess, paper waste has the lowest impact on the collection system. Participation of the same group, distribution, and the use of same sized papers, and the similarity of the paper products of students, which are presented in Appendix F, are the factors that show high levels of control on the design of the assessment.

For the pre- and post-assessments, different themes were used, in order to avoid repetition and keeping the motivation of the students relatively high. The effect of this theme difference on the findings of the study can again be considered as minimal, due to the participation of the same groups, the use of similar amounts of paper by each student, and the use of the same measurement method, which compares the two bins in terms of the ratio of disposed paper. The assessment did not deal with individual responses, it took the cumulative response of the group, which brought together the individual attitude of each student. The data used in the statistical analyses were not raw numbers showing the amount of paper collected in the bins, but the percentages that represent the ratios of the amount of paper released to the correct (recycling) bins to the total amount of paper released to both bins.

3.5.3. Statistical Analyses of the Findings

Throughout the analysis of the findings, a licenced copy of SPSS 20 software was used. The comparison of the comprehension test results and the comparison of the attitude assessments were implemented seperately, through different statistical analyses.

The reliability of the comprehension test was determined by KR-20, a measure of internal consistency (Cronbach, 1951). Items which decreased the consistency were deleted from the question pool in the pilot tests. The reliability score of the final form of the test was found to be 0.72, which is ranked as “acceptable” (DeVellis, 1991). The comparison of comprehension test results required the independent samples t-test, which is used for determining if two separate sets of data are significantly different from each other (Karasar, 2005). The independent samples t-test assumes the variances of the two groups are equal, which was corroborated by the Levene’s Test. If the test indicates unequal variances, an adjustment to the degrees of freedom is made by the Welch-Satterthwaite method, which is labeled as the “Equal variances not assumed” form by the SPSS, and proceeded with it. In addition to the t-test results that show significant differences, if any, the magnitude of difference is noted with the effect size by the Cohen’s d (Becker, 1999), which shows the mean difference between the data in standard deviation units.

For the attitude assessments, the reliability was ensured by two characteristics of the design; involvement of the same participants and measurement of the ratios of wastes, instead of amounts. In the analysis of the findings of the attitude assessment, the z-test was applied. The z-test is used to determine whether two populations or groups differ significantly on some single value representing a certain characteristic (Stangroom, 2013), which in this case was the correct bin use frequency by the students. All of the comparative tests are presented in section 4, accompanied with their descriptive visual graphs.

4. RESULTS

4.1. Baseline Information for the Analyses

Before proceeding to the comparison of the post- tests and assessments, comparison of the findings of the pre- tests and assessments, and comparison of the findings of the pre- and post- tests and assessments are presented, to see the equivalence of the groups and the change in the comprehension and attitude of the learners.

4.1.1. Comparison of Recycling Comprehension Pre-test Findings of the Groups

In order to see the difference between the comprehension pre-test scores of the two groups that received traditional and computer-based instruction, the t-test was used, along with the equal variance assumption based on the results of the Levene's Test (F=0.45, p=0.50). Table 6 and Figure 2 present the comprehension pre-test findings of the two groups with 66 and 64 participants, respectively, with the mean values representing the number of correct responses to the 21 questions in the test. The point marked with the number 66 shows the extreme value which excluded from the analysis.

Table 6. t-test for the Pre-Comprehension Levels of the Two Groups.

Groups	N	Mean	Std. Dev.	Levene's Test	t-test
Traditional	66	7.50	2.56	0.45 (P=0.50)	1.25 (p=0.22)
Computer	64	8.03	2.29		

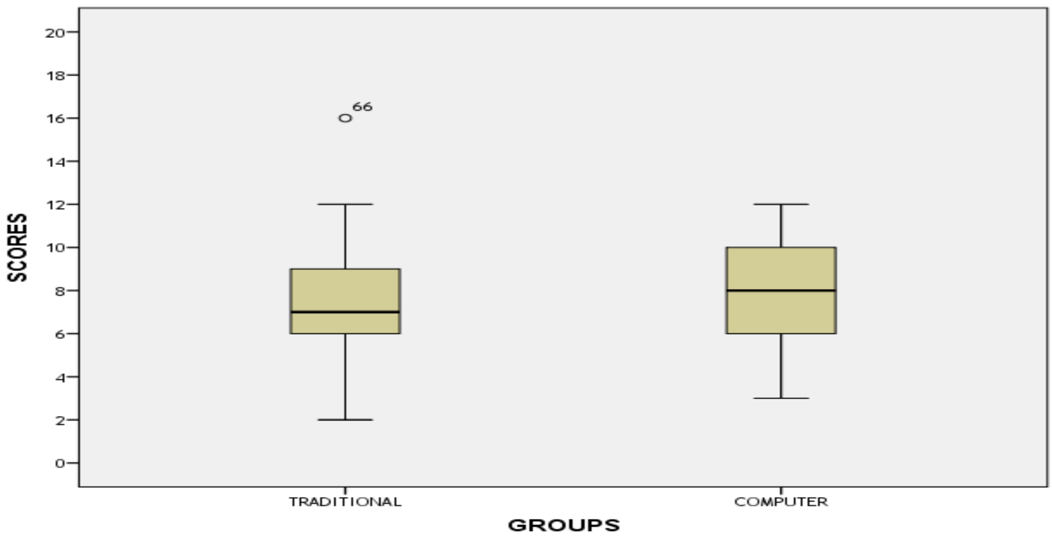


Figure 2. Number of Correct Responses in the Pre-tests of the Groups.

Even though the mean of the group that received computer-based instruction was higher, the t-test value for the comparison was 1.25 and not significant (p=0.22), which shows that there were no significant differences between the prior knowledge of the two groups. This result shows that the groups were not different in terms of their prior knowledge of the subject-matter of interest, with the conclusion that they can be tested for evaluating the effects of the two designs on learning.

4.1.2. Comparison of Recycling Attitude Pre-assessment Findings of the Groups

To compare the correct bin use of the groups before the traditional and computer-based lectures, the z-test was used. Table 7 and Figure 3 present the attitude pre-assessment findings of the two groups with 66 and 67 participants, respectively, and the percentage of the amount of paper disposed of to the correct bin, in comparison to the total amount of paper waste that was produced.

Table 7. z-test for the Pre-Attitude Levels of the Two Groups.

	Traditional	Computer
Papers released to recycling bin, g	576	642
Papers released to garbage bin, g	118	160
Rate of papers in recycling bin to total, %	83.00	80.05
z-test	1.46 (p=0.14)	

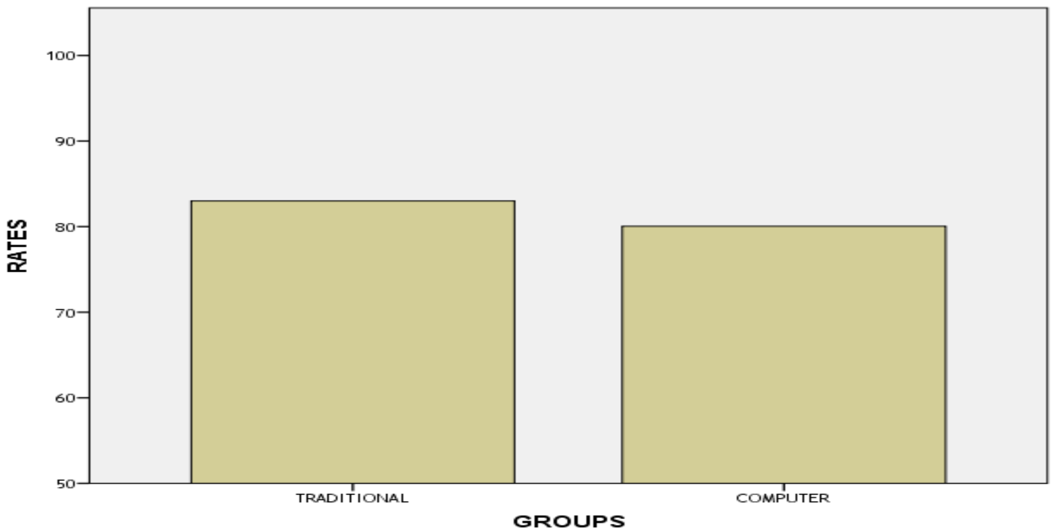


Figure 3. Percentage of Correct Disposals in the Pre-assessmets of the Groups.

The z-test value for the comparison of the two groups was 1.46, and not significant (p=0.14). This shows that there was not a significant difference between initial correct bin-use of the two groups. This result illustrates that the groups were not different in terms of their general recycling attitude and could be tested for the comparison of the two designs.

4.1.3. Comparison of Recycling Comprehension Tests of the Traditional Group

In order to see if there are any differences between the pre- and post-comprehension test scores of the group that received traditional instruction, the t-test was used, along with the equal variance assumption based on the results of the Levene's Test (F=1.44, p=0.23). Table 8 and Figure 4 present the comprehension test findings of the two groups with 66 and 52 participants, respectively, with the mean values representing the number of correct responses to the 21 questions in the test.

Table 8. t-test for the Pre and Post Comprehension Levels of the Traditional Group.

Tests	N	Mean	Std. Dev.	Effect Size	Levene's Test	t-test
Pre-test	66	7.50	2.56	0.75	1.44 (p=0.23)	12.51 (p=0.00)
Post-test	52	13.79	2.90			

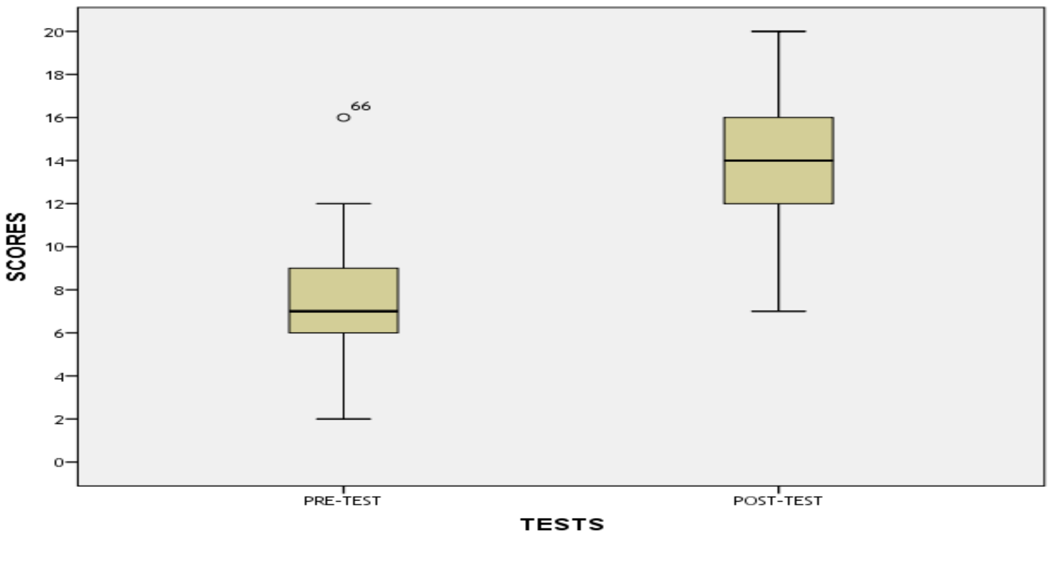


Figure 4. Number of Correct Responses of the Traditional Group.

The results of the analysis showed that the mean of the post-test was 6.29 points higher than the mean of the pre-test. The t-test value for the comparison was 13.18 and significant (p=0.00), and this showed that the instructional period had a significant effect on the group that received traditional instruction, in terms of the increase in the knowledge on the subject-matter of interest.

4.1.4. Comparison of Recycling Attitude Assessments of the Traditional Group

To find out the difference between the correct bin use of students before and after the traditional lectures, the z-test was used. Table 9 and Figure 5 present findings of the attitude assessments with 66 and 54 participants, respectively, and the percentage of the amount of paper disposed of to the correct bin, in comparison to the total amount of paper waste that was produced.

Table 9. z-test for the Pre and Post Attitude Levels of the Traditional Group.

	Pre-test	Post-test
Papers released to recycling bin, g	576	412
Papers released to garbage bin, g	118	38
Rate of papers in recycling bin to total, %	83.00	91.56
z-test	4.12 (p=0.00)	

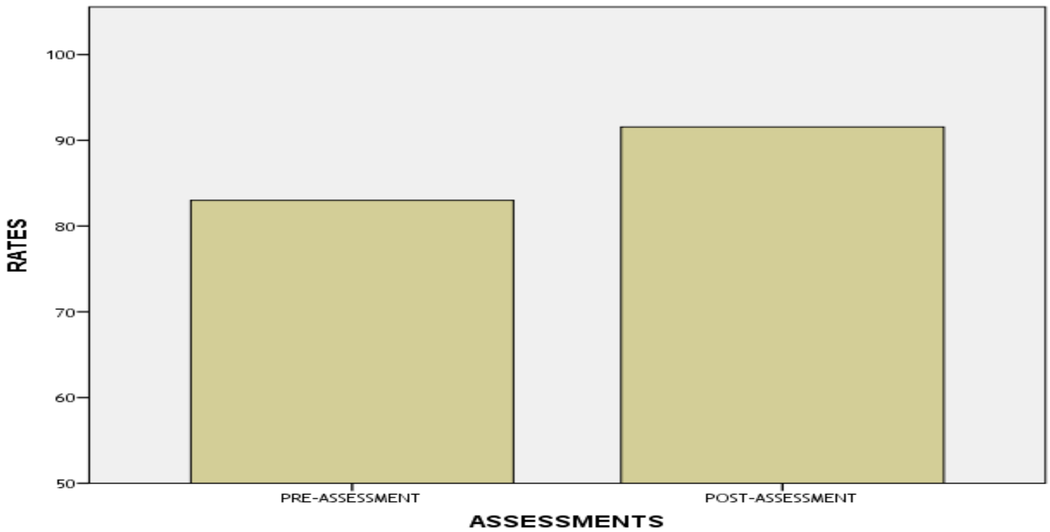


Figure 5. Percentage of Correct Disposals of the Traditional Group.

The results of the analysis showed that the mean of the post-assessment was 8.56% higher than the mean of the pre-assessment. The z-test value for the comparison was 4.12, and significant (p=0.00), and this showed that the instructional period had a significant effect on the group that received traditional instruction, in terms of increase in the attitude on the subject-matter of interest.

4.1.5. Comparison of Recycling Comprehension Tests of the Computer Group

In order to see if there are any differences between the pre- and post-comprehension test scores of the group that received computer-based instruction, the t-test was used, along with the rejection of equal variance assumption based on the results of the Levene's Test (F=13.23, p=0.00). Table 10 and Figure 6 present the comprehension test findings of the two groups with 64 and 49 participants, respectively, with the mean values representing the number of correct responses to the 21 questions in the test.

Table 10. t-test for the Pre and Post Comprehension Levels of the Computer Group.

Tests	N	Mean	Std. Dev.	Effect Size	Levene's Test	t-test
Pre-test	64	8.03	2.29	0.67	13.64 (p=0.00)	9.26 (p=0.00)
Post-test	49	13.24	3.39			

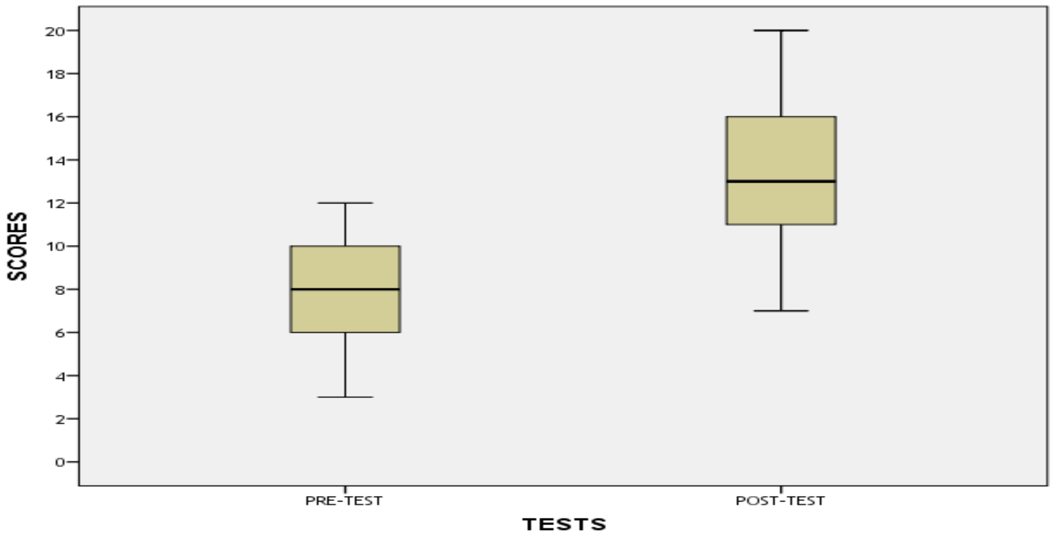


Figure 6. Number of Correct Responses of the Computer Group.

The results of the analysis showed that the mean of the post-test was 5.21 points higher than the mean of the pre-test. The t-test value for the comparison was 9.26 and significant (p=0.00), and this showed that the instructional period had a significant effect on the group that received computer-based instruction, in terms of increase in the knowledge on the subject-matter of interest.

4.1.6. Comparison of Recycling Attitude Assessments of the Computer Group

To find out the difference between the correct bin use of students before and after the computer-based lectures, the z-test was used. Table 11 and Figure 7 present findings of the attitude assessments with 67 and 55 participants, respectively, with the percentage of the amount of paper disposed of to the correct bin, in comparison to the total amount of paper waste that was produced.

Table 11. z-test for the Pre and Post Attitude Levels of the Computer Group.

	Pre-test	Post-test
Papers released to recycling bin, g	642	428
Papers released to garbage bin, g	160	58
Rate of papers in recycling bin to total, %	80.05	88.07
z-test	3.72 (p=0.00)	

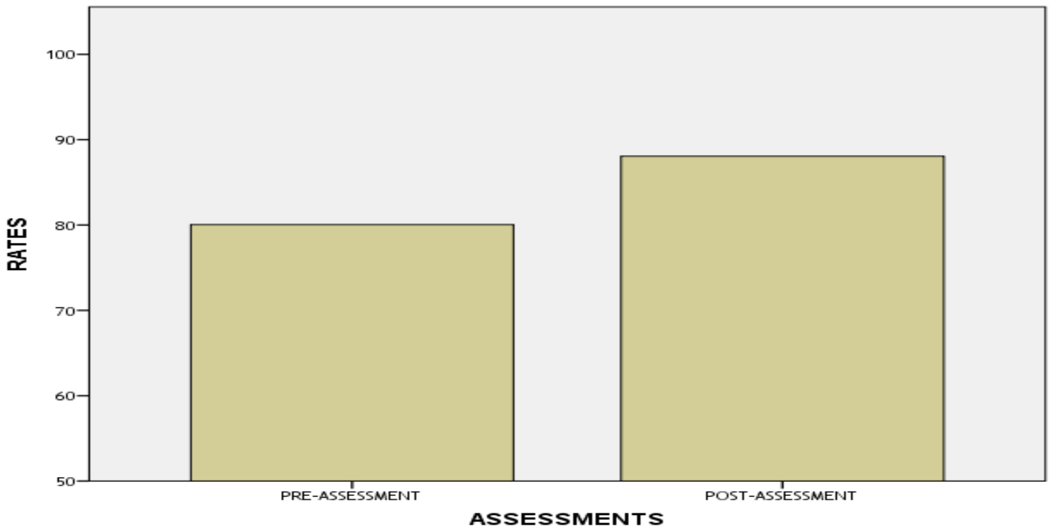


Figure 7. Percentage of Correct Disposals of the Traditional Group.

The results of the analysis showed that the mean of the post-assessment was 8.02% higher than the mean of the pre-assessment. The z-test value for the comparison was 3.72, and significant (p=0.00), and this showed that the instructional period had a significant effect on the group that received computer-based instruction, in terms of the increase in the attitude on the subject-matter of interest.

4.2. Tests of Hypotheses

After seeing no differences at the beginning between the two groups, and observing a significant change after the lectures, the effect of the instructional designs are compared in the following section, in terms of comprehension and attitude outputs, as presented below.

4.2.1. Test of the First Hypothesis

The first hypothesis of the study was "There is not any significant difference between the recycling comprehension test results of learners who receive traditional and computer-based instructions". In order to test this hypothesis, the difference between the comprehension test results of the groups was analysed by the t-test. Table 12 and Figure 8 present the comprehension post-test findings of the two groups with 52 and 49 participants, respectively, with the mean values representing the number of correct responses to the 21 questions in the test.

Table 12. t-test for the Post-Comprehension Levels of the Two Groups.

Groups	N	Mean	Std. Dev.	Levene's Test	t-test
Traditional	52	13.79	2.90	2.61 (p=0.11)	0.87 (p=0.39)
Computer	49	13.24	3.39		

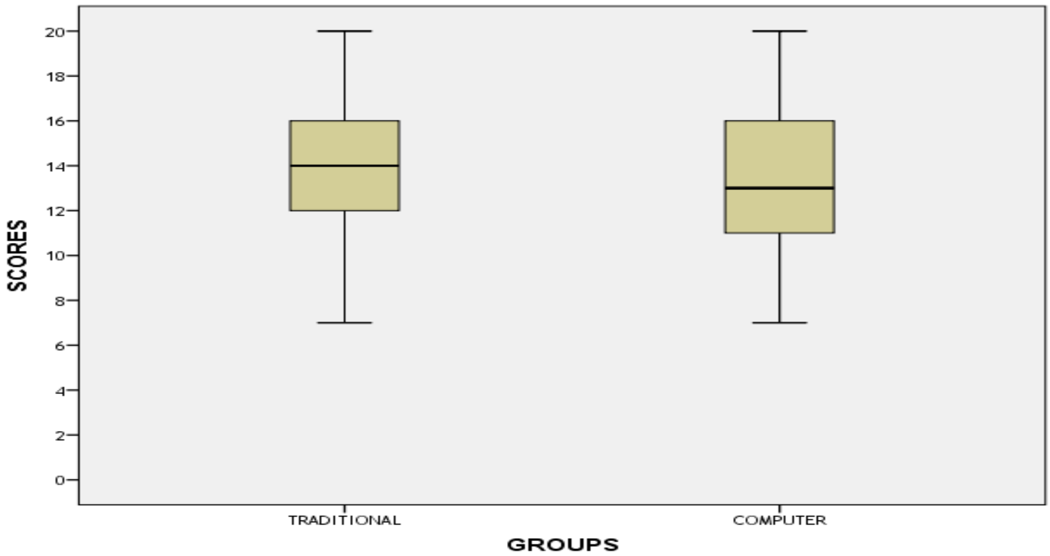


Figure 8. Number of Correct Responses in the Post-tests of the Groups.

The result of the analysis showed that the small difference of 0.55 points in favor of the group that received computer-based instruction was not significant. The t-test value for the comparison was 0.87 and not significant (p=0.39) showing that there were no significant differences between the final knowledge of the two groups. This result shows that, besides the significant positive increase in the relevant knowledge, neither of the instructional designs was more effective than the other, in terms of establishing the knowledge on the subject-matter of interest.

4.2.2. Test of Second Hypothesis

The second hypothesis was “There is not any significant difference between the recycling attitude test results of learners who receive the courses through traditional and computer-based instructions”. To test this hypothesis, the difference between the attitude outputs of the groups was determined, where the z-test was used to test for the statistical significance of differences. Table 13 and Figure 9 present the attitude post-test findings of the groups with 54 and 55 participants, respectively, with the percentage of the amount of paper disposed of to the correct bin, in comparison to the total amount of paper waste that was produced.

Table 13. z-test for the Post-Attitude Levels of the Two Groups.

	Traditional Group	Computer Group
Papers released to recycling bin, g	412	428
Papers released to garbage bin, g	38	58
Rate of papers in recycling bin to total, %	91.56	88.07
z-test	0.61 (p=0.54)	

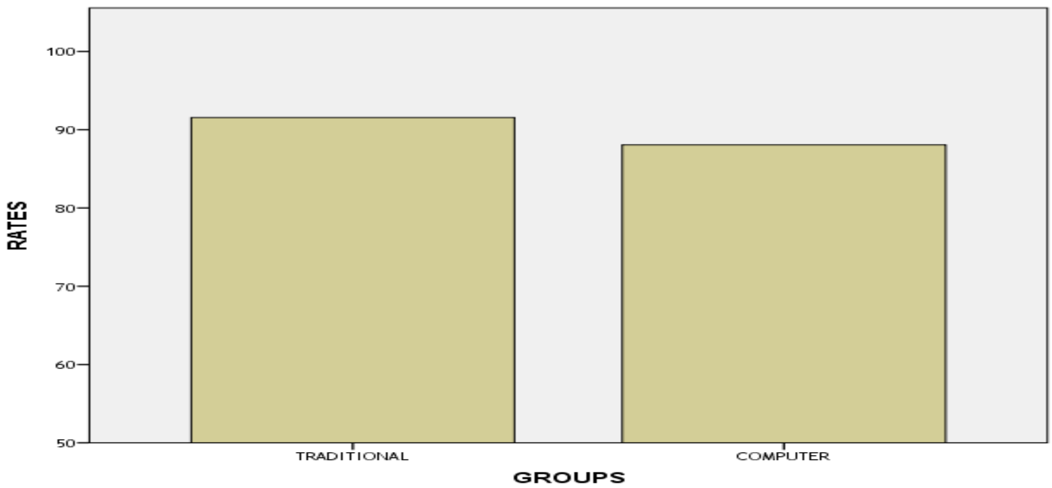


Figure 9. Percentage of Correct Disposals in the Post-tests of the Groups.

The z-test value for the comparison of the two groups was 0.61, and not significant (p=0.54). This shows that there was not a significant difference between the final correct bin-use of the two groups. This result shows that, although there was significant positive increase in the relevant attitude, neither of the instructional designs was more effective than the other, in terms of increasing the positive attitude with regards to the subject-matter of interest.

5. DISCUSSION

5.1. Initial Findings and the Change in the Achievement of Students

Before proceeding to the comparison of the effect of the instructional designs, initial use of recycling bins and the increase in comprehension and attitude are considered. In this context, the remarkable high rates of initial use, and the expected increase in comprehension and attitude are discussed below.

5.1.1. High Rates of Recycling Bin Use Before the Instruction

At the pre-test period before the instruction, recycling bins were the only objects in the classrooms that contained information about recycling. Even at this time, at the very beginning, rates of correct use of recycling bins were high, between 80% and 83%. These initial rates observed in this study can be based either on former nonformal out-of-school experiences or the experiences obtained in former formal educational settings, or more likely, both.

Learning is affected by various factors related to the learners themselves, as well as the educational environment (Erden and Akman, 2001). Physical factors such as health and nutrition, psychological factors such as confidence and motivation, social factors such as family and peers, and educational factors such as relevance and difficulty of the topic govern learning (Skilbeck, 2006).

Taking into account the significantly high initial recycling rates in the study, social factors should be considered. Effective aspects of social factors are largely denoted by circular diagrams, where the family-school-peers triangle is at the centre (Kidsmatter, 2008). In the daily contact with the constituents of this triangle, children learn about the social world, rules, practices, and values. Depending on consequences, observation of a behavior of a model can strengthen or weaken the probability of the reproduction of that particular behavior by the observer (Bandura, 1986). Beliefs and behaviors that are encouraged or positively received by the peer group are also more likely to be displayed again, and vice versa (Erden and Akman, 2001; Ryan et al., 2009). Sharing experiences and exchanging information also influence attitudes (Kindermann, 1993; Ryan, 2001).

Following this core, development is affected by wider networks. Individuals are continuously affected by visual media, including the products targeted directly towards certain age groups, as noted in section 2.1.1. As a peculiar parameter in this study, the recycling bins have an instructional effect both by just existing in the learning environment and by bearing informatory notices on them. The effect of bins and their characteristics have an important role on recycling rates, as noted in section 2.1.3. It is apparent that these parameters can have a cumulative effect on the high initial recycling rates.

Studies comparing formal and nonformal experiences note that nonformal education has considerable effect on the actions of individuals, even greater than formal education in certain cases (Wellington, 2007; Ramey-Gassert, 1997). Nonformal environments provide experiences that can be related closely to objectives, and can be useful in formal education if used carefully. Througout the schooltime, besides the formal instruction, students in the study were also interacting with each other, and using the recycling bins that had relevant instructions on them, which might have affected the rates. Yet, this does not affect the findings of the comparison where just the difference between the two groups was analysed.

5.1.2. The Increase in Comprehension Test Results

For both groups, there were significant increases in comprehension; thus, the results show that both instructional methods seemed to be effective in understanding the basics of recycling, considering its necessities and benefits. Reducing the amount of waste sent to landfills and incinerators, conserving natural resources, preventing pollution, saving energy, and generating new jobs for people are considerable gains that can be attained by small changes in educational settings.

Moreover, learning about recycling – its implementation, factors affecting it, inputs and outputs of the processes, and its importance – can also have an indirect positive effect on the approach of students to other topics and subject areas by making them realize, think, and apply what they have learned.

As noted in part 2.2.3, the choice of the educational setting as traditional or computer-based should also be considered as an important parameter of the teaching-learning duo. For instance, where access to school is not easy, or importance of personal interaction is negligible, use of software can become a good option. Likewise, for topics which need multi-sensory interaction, or where the homework load is greater, the traditional design can be applied.

5.1.3. The Increase in Attitude Assessment Results

The increase in the correct choice of the bin to recycle the material produced during the lectures was similar, about 10%, for both groups. In Turkey, when the amount of recovery of recyclable materials and the pupulation is considered, it can be concluded that any percental increase can have a substantial effect. The average weight of recycled material in Turkey is around 25 million tonnes per year (TÜİK, 2014) which is far behind that of the developed countries (UNEP, 2012). In addition, the number of primary school students in Turkey, which is over 5 million, shows the need and significance of possible enhancements on this topic (TÜİK, 2016).

The increase in this study, which is statistically significant, can be considered as the result of lectures given during the study. Meanwhile, it may also be a result of other elements of the learning environment, such as the further interaction of students and existance of informatory recycling bins in the classrooms, as noted in part 5.1.1. In any case, a well-designed recycling part in the curriculum, or at least, well-placed and well-designed recycling bins at schools can help increase these numbers at the national level.

Literature also presents that the effect of the instructor may be less, compared to peer effect, depending on the structure of the topic. It is noted that instructor effect is dominant for understanding and practising challenging concepts that require higher order thinking and skills, but peer effect becomes stronger in broader and participatory objectives (Eryılmaz et al., 2014; Hogan et al., 1999; Yang et al., 2006; Gopinath, 1999; Cuijpers, 2002). To this extent, characteristics of the recycling theme can be noted as having broad and participatory objectives leading to a greater peer effect.

Can such an increase in correct attitudes be a reasonable goal for environmental education? The answer for this question may depend on the quality and the workload of curricula, as well as other relevant costs such as training instructors and developing and acquiring software. A curriculum which covers essential topics may not be flexible enough to have some of its core topics replaced with recycling lectures, considering that these lectures have only a small effect on students behavior – to be exact, a 10% increase in students' recycling behavior. On the other hand, not all other lectures have significantly higher effects on students' knowledge or behavior either. These other lectures which have similarly expected effects on students can justifiably be replaced by recycling lectures, especially since a 10% increase in recycling is not a negligible improvement for the environment. It might not be possible to replace some of the core topics of a curriculum with recycling related topics which are expected to change the attitude by only about 10%. On the other hand, when the effect of such an increase in recycling attitude on the environment is considered, replacement of sections that have similarly expected effects on students, and are optional in the curriculum, could be justified.

The goal of environmental education is noted in parts 1.1.3 and 2.1.1. By definition, environmental education aims to direct individuals to be concerned about the environment and its related problems, and have them acquire the knowledge, attitude, skills, motivation, and commitment to work individually and collectively toward solutions to current problems and prevention of new ones. In this perspective, it is apparent that the theme of recycling bears great importance in education. The global environmental issue of reducing the amount of garbage released into nature is directly related to the proper attitudes, and thus, to the relevant education on recycling, as mentioned in section 1.1 in greater detail above. Due to its easy structure, recycling can be understood and practiced at any age starting from childhood. The benefits of recycling: reducing waste, conserving natural resources and energy, preventing pollution, and generating new jobs for people, cannot be overlooked.

5.2. Comparison of Post-test Results of the Groups

In this study, no significant difference was observed between the effects of traditional and computer-based instructions for either comprehension of the topic or the relevant attitude. As noted in literature, findings of comparisons of the two designs show varying results. Meta-analyses on the comparative studies, addressing 542 independent comprehension and attitude outcomes also note that the findings do vary to a great extent. The noted studies point to each of the three possibilities; superiority of one design to the other, or their equivalence, with an equal distribution in the grand total (Bernard et al., 2004). Thus, the results of this study, which note no significant differences on comprehension and attitude outcomes between the learners who receive traditional and computer-based instructions, provide another data point for the literature with regards to the equivalency of the two designs, concerning recycling.

Educators have been doubting the value of much of what currently passes for schooling, and many ask if schooling and education have very much in common, or are even compatible (Wheldall and Glynn, 1989). Carroll’s model (1963) proposes that if each learner is allowed the time he needs to learn a context and if he spends the necessary time then he would probably attain it. Yet, it was also noted that the quality of instruction and the competence of the learner were joint factors in the model (Block and Anderson, 1975). As a whole, learning is determined by quality of the instruction, learner characteristics, and time. As can be noticed, none of these factors deals with the in-school/out-of-school distinction. Hence, courses and topics can be specified under two groups: those that essentially need to be carried out at schools, and those that do not. Thus, an approach of testing the topics within traditional and computer-based application comparisons can be a valid method besides the meta-anlysis results noting that computer-based instructions are more effective in higher grade levels and science related subjects (Roblyer et al., 1988).

Going further, a great handicap for us is our own perception of the education system. We take schools strangely for granted. In other words, we tend to see the current school system as an obvious, necessary, and permanent part of our lives when we are children and of our children's lives when we are adults. We accept a view that schools have to be the way they are now: children waking up before sunrise to fullfil the time they ought to spend at a certain instructional place. Schools are certainly needed and useful but, in their current form, they may not be as crucial in today's education system as we think. Schools must function more effectively and positively. An important step for this is determining the topics which are important to be taught and learned at schools. In this context, a large number of courses from elementary stages to higher levels can be found to be non-essential for learning at school. Taking out these courses from in-school practices would not lead to a loss in curricula; conversely, it would provide students time and energy that they could spend on more beneficial activities for their development. Wheldall and Glynn (1989) give us pause by asking us to imagine how we might feel if we found ourrselves forced to spend up to 6 or 7 hours a day, locked up with 20 or 30 others, sentenced to a term of periodic supervision, performing repetitive tasks, many of which have no meaning.

Even about 40 years ago, the question "Why do all educational organisations look the way they do, and why do they all look the same?" (Weick, 1976) was asked. It was suggested that the common structural and organisational elements in schools were not a result of the true task of education but a consequence of certification processes. It is also noted that the influences on achievement of learners are multilevel and the net effect of classrooms is higher than that of schools (Kyriakides et al., 2000). Coutts (2015) notes that, if schools were designed to best serve their fundamental task, they would look different and there would be general differences between them as a result of their intentions and purposes. As Gore (2013) points out, our civilization has barely begun the essential process of adapting schools to the structural shift in our relationship to the world of knowledge. There is a great potential for development of new curricula, with tablet-based e-books and search-based, immersive, experiential, and collaborative online courses. The future has the potential to be irreversibly different from the past. So, we should lessen the difference between what “is” and what “ought to be”. Management of wastes is an essential component in this, where educational adjustments can bring out important differences, as noted in this study.

5.3. Conclusion and Recommendations

This study presented and compared two instructional designs for the recycling theme to test the probable difference between the performance of learners who took the instructions. Analyses focused on the change in comprehension and attitude levels of the learners on recycling. Firstly, neither of the designs were found to be more effective than the other in terms of establishing the knowledge on the subject-matter of interest. Secondly, likewise, neither of the designs were found to be more effective than the other, in terms of increasing the positive attitude on the subject-matter of interest. Nevertheless, both designs led to a significant increases in relevant knowledge and attitude.

As in every study, further suggestions can also be presented for teaching recycling, which has both environmental and educational aspects. Here, suggestions are stated under two titles: further development of the study and enhancements for recycling.

In comparing two designs for the same topic, instructional forms and the study can always be developed further. Even, in theory, some educators believe that two instructional designs cannot have perfectly equalized forms for a valid comparison (Allen et al., 2012). Intently, in this study, we tried to implement an exact one-to-one equavalent design pair of instructions, without employing every possible method and technique, which would have been redundant. Yet, alterations in these instructions can be done; by using innovative, issue-based activities, it is possible to enhance students' attitudes about the relevance of science related topics (Siegel and Ranney, 2003). In addition, the study can be enhanced by including follow-up tests or covering a greater number of participants. Also, supplementary research can be implemented for more data, by adding a control group and/or providing recycling bins without any relevant instructions on them. It should also be noted that the study had the limitations of working on a particular group (students from a public school of an intermediate socio-economic area of a metropolitan region), particular instructional designs (traditional and computer-based), and a particular subject (recycling).

Above all, primarily, this study could be enhanced by moving the instructional process of the computer-based group completely to the out of the shool. This arrangement could potentially show the actual difference in the output of the groups more precisely. However, the experimental design of such work would be harder for keeping the general setup and the external factors under control.

Other than such efforts for preparing effective instructions, daily settings can further be developed, as noted in section 2.1.3. Learning in daily life has an important impact on the attitude of individuals towards the environment, including their indoor and outdoor environmental practices (Ballantyne and Packer, 2010). It is noted that science-related subjects are learned best by conducting hands-on engaging acts using simple everyday materials (Ramey-Gassert, 1997).

Considering lifelong learning, society should be provided regularly with up-to-date knowledge, since environment – and recycling as a part of it – is a topic that changes over time in tandem with technological improvements and new regulations. In this respect, visual media can be an important tool in delivering information. In addition, bins can be made to be more attractive and can be placed in more visible locations and in higher numbers. Moreover, compulsory practices can be used, as is the present case in Germany, whereby each of the specific piles of trash is collected by a certain type of collector and any type of trash which is put in the wrong bag is left by the collectors with a notification.

The main objective of this study was to contribute to the efforts to increase recycling rates through compulsory education. Achieving this aim requires that we determine which instructional design is more efficient in teaching recycling. In this context, this study presented and compared two instructional designs –traditional and computer-based lectures on recycling– in the broadest frame, to test the difference between the outputs of learners. This comparison aimed to determine if either of these approaches had greater effects in helping students understand and practice the concept.

The results presented show no significant differences between the effects of the two designs for either comprehension of the content or the relevant attitude on recycling. Thus, the main conclusion of the study is that either design can be selected for teaching the topic while taking into consideration other parameters about learners and the curriculum. As elaborated in the final chapter, determining the most efficient instructional design for recycling requires further studies to be conducted. Comparing designs could also be beneficial for other environmental themes and subject areas.

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APPENDIX A: THEME OF RECYCLING IN THE CURRICULUM AND THE RELEVANT PAGES IN THE TEXTBOOK

T.C. MİLLÎ EĞİTİM BAKANLIĞI
TALİM VE TERBİYE KURULU BAŞKANLIĞI
İLKÖĞRETİM HAYAT BİLGİSİ DERSİ ÖĞRETİM PROGRAMI

1.2. PROGRAMIN VİZYONU

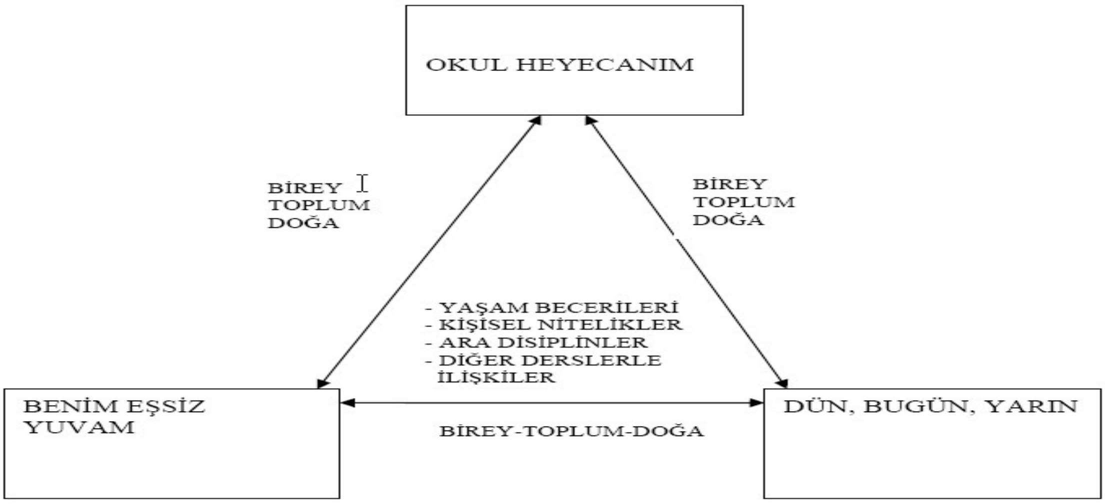
Bu programın vizyonu, hayat bilgisi dersine ayrılan zamanın büyük bölümünde öğrencilerin kendi girişimleriyle gerçekleştirecekleri ve öğretmenlerin öğrencilere doğrudan bilgi aktarmak yerine sadece ve sadece yol göstereceği etkinlikler aracılığıyla,

- Öğrenmekten keyif alan,
- Kendisiyle, toplumsal çevresiyle ve doğa ile barışık,
- Kendini, milletini, vatanını ve doğayı tanıyan, koruyan ve geliştiren,
- Gündelik yaşamda gereksinim duyulan temel bilgilere, yaşam becerilerine ve çağın gerektirdiği donanıma sahip,
- Değişikliklere dinamik bir biçimde uyum sağlayabilecek kadar esnek,
- **Mutlu** bireyler yetiştirmektir.

1.3. PROGRAMIN TEMEL YAKLAŞIMI VE YAPISI

Hayat Bilgisi Dersi Programı'nda insan, biyolojik, psikolojik, sosyal ve kültürel yönleriyle bir bütün olarak ve değişimin hem öznesi hem de nesnesi olarak ele alınmıştır. Bu noktadan hareketle "**birey**", "**toplum**" ve "**doğa**" olmak üzere üç ana öğrenme alanı belirlenmiş, değişim de bütün bu öğrenme alanlarını kuşatan daha genel bir boyut olarak düşünülmüştür. Gerçek yaşamda bu öğrenme alanlarının içerikleri ve değişim iç içedir; bunlar sadece eğitim-öğretim amacıyla yapay olarak birbirinden ayrılabilir. Hayat bilgisi dersi için özellikle benimsenen toplu öğretim yaklaşımının da bir gereği olarak, bu öğrenme alanlarını aynı anda kuşatabilen üç tema belirlenmiştir. Programda tema adları; "**Okul Heyecanım**", "**Benim Eşsiz Yuvam**" ve "**Dün, Bugün, Yarın**" olarak kararlaştırılmıştır (TABLO-1).

TABLO-1: Hayat Bilgisi Dersi Programı'nın Çatısı



Hayat Bilgisi Dersi Programı'nda çocukların temel yaşam becerilerinin yanı sıra, olumlu kişisel nitelikler geliştirmeleri amaçlanmıştır. Bunlara ek olarak çocukların sosyal bilgiler, fen ve teknoloji derslerine temel oluşturacak nitelikte bilgilere de sahip olmaları beklenmektedir. Dolayısıyla programda bu ögeler (öğrencilerin temel yaşam becerileri ve olumlu kişisel nitelikler geliştirmelerine yardımcı olmak, sosyal bilgiler ve fen ve teknoloji derslerine temel oluşturacak bilgiler kazanmalarına fırsat yaratmak), belirlenen temalarla bütünleştirilecek şekilde "**kazanımlar**" oluşturulmuştur.

Kazanımlar, çocukların doğrudan gözlenebilir davranışlarının yanı sıra, bilgi, beceri, tutum ve değerleri de içeren ifadelerdir. Kazanımlar belirlenirken konu bütünlüğünden çok, beceriler esas alınmıştır. Programda yer alan kazanımların, öğrenciler tarafından gerçekleştirilecek etkinlikler aracılığıyla elde edilmesi söz konusudur. Bu nedenle de öğrenme-öğretme etkinlikleri, bu programın en kritik ögesidir. İleride daha ayrıntılı bir biçimde açıklanacağı gibi, programda kazanımların türüne ve niteliğine göre uygun ölçme araçlarının kullanılmasına izin veren bir yaklaşım benimsenmiştir. Programda hayat bilgisi dersi ile diğer derslerin kazanımları ve ara disiplinlere aitkazanımlar arasında da ilişkiler gözetilmiştir.

Programın öncelikli amacı, öğrencilerin temel yaşam becerilerini kazanmalarına ve olumlu kişisel nitelikler geliştirmelerine yardımcı olmaktır. Bununla birlikte hayat bilgisi dersinde öğrenciler aynı zamanda 4 ve 5. sınıf programlarında yer alan sosyal bilgiler, fen ve teknoloji derslerine temel oluşturabilecek bilgileri de kazanacaklardır.

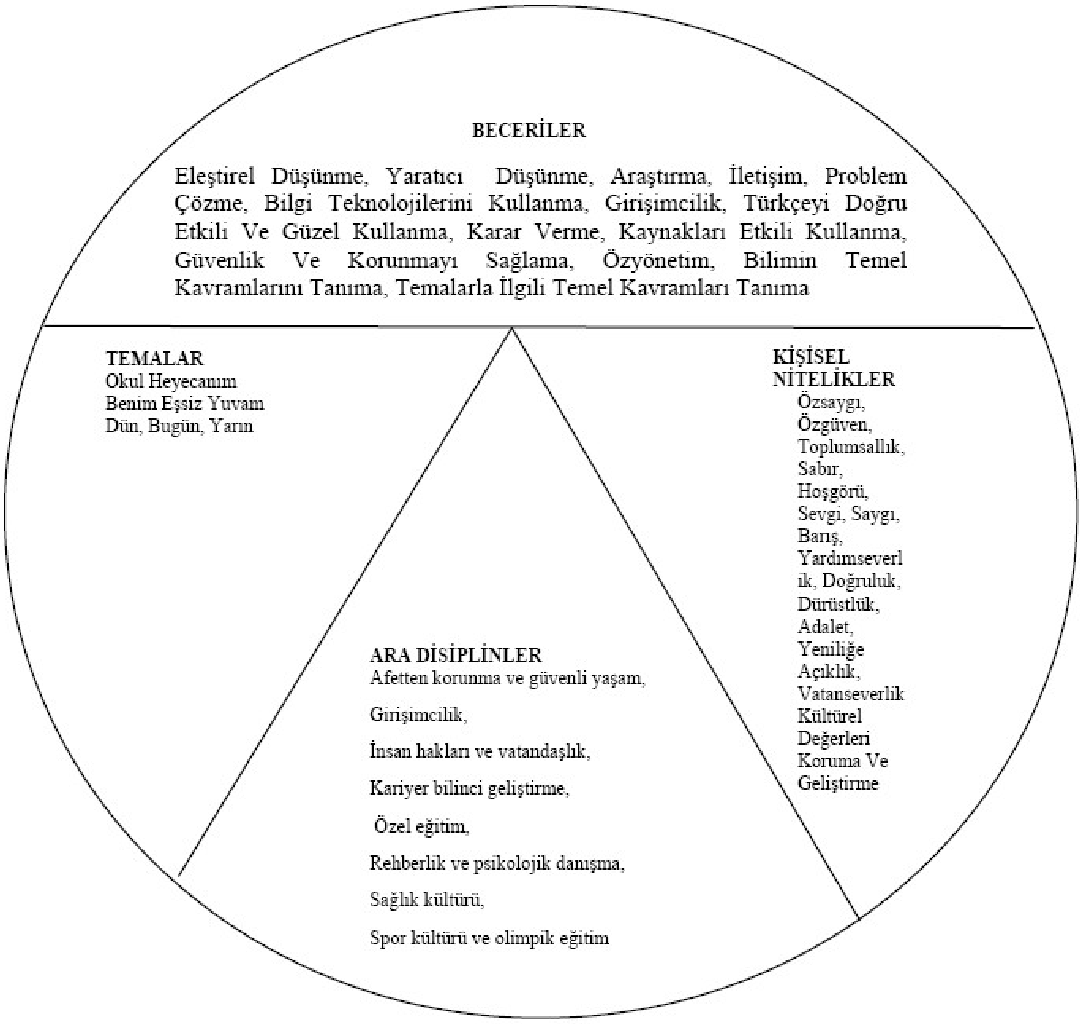
BECERİLER

Program ile öğrencilerin şu becerileri kazanmalarına yardımcı olunacaktır:

1. Eleştirel düşünme
2. Yaratıcı düşünme
3. Araştırma
4. İletişim
5. Problem çözme
6. Bilgi teknolojilerini kullanma
7. Girişimcilik
8. Türkçeyi doğru, etkili ve güzel kullanma
9. Karar verme
10. Kaynakları etkili kullanma
10.1. Zaman, para ve materyal kullanma
10.2. Bilinçli tüketici olma
10.3. Çevre bilinci Geliştirme ve çevredeki kaynakları etkili kullanma
10.4. Planlama ve üretim
11. Güvenlik ve korunmayı sağlama
11.1. Sağlık ve güvenlik kurallarına/ prosedürlerine uyma
11.2.Doğal afetlerden korunma
11.3. Trafikte güvenliğini sağlama
11.4. Hayır diyebilme
11.5. Sağlığını koruma
12. Öz yönetim
12.1. Etik davranma
12.2. Eğlenme
12.3. Öğrenmeyi öğrenme
12.4. Amaç belirleme
12.5. Kendini tanıma ve kişisel gelişimini izleme

12.6. Duygu yönetimi
12.7. Kariyer planlama
12.8. Sorumluluk
12.9. Zamanı ve mekânı doğru algılama)
12.10.Katılım, paylaşım, işbirliği ve takım çalışması yapma
12.11.Liderlik
12.12.Farklılıklara saygı duyma
13. Bilimin temel kavramlarını tanıma
13.1. Değişim
13.2. Etkileşim
13.3. Neden – sonuç ilişkisi
13.4. Değişkenlik/benzerlik
13.5. Karşılıklı bağımlılık
13.6. Süreklilik
13.7. Korunum
14. Temalarla ilgili temel kavramları tanıma

TABLO-3: Hayat Bilgisi Dersi Programı'na İlişkin Beceriler, Temalar, Ara Disiplinler ve Kişisel Nitelikler



1.3.1. Öğrencilere Kazandırılacak Beceriler

1.3.1.10. Kaynakları Etkili Kullanma

10.2. Bilinçli Tüketici Olma

- Elektrik, su vb. kaynakları tutumlu kullanma
- Tüketici olarak belli haklara sahip olduğunu kavrama
- Haklarını nasıl kullanacağını ve hakları ihlâl edildiğinde kime/nereye başvurabileceğini açıklama
- Reklâmlarla tüketici hakları arasında ilişki kurma
- Reklâmlar yoluyla isteklerinin nasıl yönlendirildiğinin farkında olma
- Tüketim yaparken bütçesine göre ihtiyaçlarına öncelik verme
- Bilinçli tüketicinin ayırt edici özelliklerini belirleme ve uygulama
- İhtiyaçlarını önceden tespit etme ve önem sırasına göre sıralayarak liste yapma
- Satın alınan ürünleri temiz, düzgün kullanma ve iyi saklama
- Tutumlu olma
- Verilen harçlıklarla haftalık, aylık bütçeler yapma
- Gereksiz yere para harcamama
- Yiyecek ve içeceklere özen gösterme
- Açıkta satılan yiyeceklerden uzak durma
- Gazlı içecekler yerine mümkün olduğu kadar süt, ayran ve doğal meyve sularını tercih etme
- Çok fazla abur-cubur tüketmeme
- Beslenme çantasına evde hazırlanmış doğal gıdalar ve taze meyve koyma

10.3. Çevre Bilinci Geliştirme ve Çevredeki Kaynakları Etkili Kullanma

- Yaşadığı çevre ile bir bütün olduğunu fark etme
- İnsanla çevre arasındaki karşılıklı etkileşimi görme
- Çevreye zarar vermenin kendine zarar vermek olduğunu kavrama
- Kendi kültürünü ve başkalarının kültürlerini keşfetme ve kültürün farklılıklarını veya benzerliklerini tanıma
- Kültürel eserleri koruma

1.3.1.12. Öz Yönetim

12.8.Sorumluluk

- Yaşamın farklı boyutlarındaki sorumluluklarının farkına varma ve sorumluluk üstlenmenin kişisel gelişimi açısından önemini açıklama
- Zamanında ve düzenli olarak derslere girme gibi uygun çalışma standartlarını uygulama
- Ödevlerini tamamlayarak kendi çalışmalarının sorumluluğunu üstlenme
- Verilen görevleri, yetenekleri ölçüsünde elinden geldiğince en iyi şekilde yapma
- Üretken bir biçimde çalışma ve görevlerini aksatmadan yerine getirme
- Davranışlarının sonuçlarını üstlenme
- Başkalarının haklarını çiğnemeden kendi ihtiyaçlarını karşılama
- Toplumsal sorumlulukların yerine getirilmesinde bilgi edinme, plan yapma, örgütlenme ve harekete geçme sürecinin önemini kavrama
- Daha iyi bir dünya için kendi yaş grubundakilerin de sorumlulukları olduğunu fark etme

1.3.1.13. Bilimin Temel Kavramlarını Tanıma

13.1. Değişim

- Çevresindeki her varlığın sürekli bir değişim içinde olduğunu ve bunun doğal olduğunu fark etme (Bireyin fiziksel özellikleri, giysileri, duyguları, izin verilen/verilmeyen davranışları vb.)
- Zamanın değiştiğini fark etme ve zamana bağlı diğer değişimleri kavrama
- Mekândaki değişimi kavrama
- Canlılardaki değişimi, evrelerini ve sebeplerini kavrama
- Doğadaki değişimleri fark etme ve sebeplerini kavrama

13.2.Etkileşim

- Her varlığın, nedensel bir değişime yol açacak şekilde sürekli olarak birbirini etkilediğini fark etme
- İnsan, hayvan ve bitkilerin birbirlerini etkilediğini; bitkilerle hayvanların birbirlerini etkilediğini; insan, hayvan ve bitkilerin de fiziksel çevreyi etkilediğini fark etme

13.3. Neden-Sonuç İlişkisi

- Maddelerde ve canlılarda meydana gelen değişikliklerin genellikle belli bir nedene bağlı olduğunu fark etme

13.4. Değişkenlik / Benzerlik

- Benzer veya aynı özelliklere göre sınıflandırılabilseler bile, her şeyin birbirinden farklı olduğunu kavrama

13.5. Karşılıklı Bağımlılık

- Yaşayan her varlığın, canlı ya da cansız diğer bütün varlıklarla ve çevre ile etkileşim içerisinde olduğunu kavrama

13.6. Süreklilik

- Yaşamın asla sona ermediğini fark etme (Deprem, savaş, salgın hastalık gibi güçlere rağmen hayatın devam etmesi vb.)
- Değişen olay ve olgular gibi değişmeyen, süreklilik gösteren olay ve olguların da var olduğunu fark etme

13.7.Korunum

- Maddelerin değişebildiklerini ama yok olmadıklarını fark etme

1.4.ÖĞRENME-ÖĞRETME SÜRECİ

1.4.3. Kavramlar

Hayat bilgisi dersinin temel amacı, öğrencilerin günlük yaşamda ihtiyaç duydukları ve kullanabilecekleri yaşam becerilerini kazanmalarına yardımcı olmaktır. Bunun yanı sıra çocukların ileride alacakları fen bilgisi ve sosyal bilgiler derslerine temel oluşturabilmeleri için bazı kavramlar da tanıtılacaktır. Böylece çocukların temel bilgi ve becerilerle donanmış, istenen kişisel niteliklere sahip birer yurttaş olarak yetişmeleri sağlanacaktır.
Hayat Bilgisi Dersi Programı'nda bu amaçla aşağıdaki kavramlara yer verilmiştir:

TABLO-9: Hayat Bilgisi Dersi Programında Yer Alan Kavramlar

DÜN, BUGÜN, YARIN		
1. SINIF	**2. SINIF**	**3.SINIF**
▪ Geçmiş ▪ Şimdi ▪ Gelecek ▪ Oyuncak ▪ Öz geçmiş ▪ Anı ▪ Kılık-kıyafet ▪ Değişiklik ▪ Mevsim ▪ Takvim ▪ Hava durumu ▪ Yeryüzü ▪ Gökyüzü ▪ Renk ▪ Dünya ▪ Gün	▪ Değişim ▪ Karşılaştırma ▪ Aile büyüğü ▪ Hayat ▪ Katı-sıvı-gaz ▪ Neden-sonuç ▪ Hava ▪ Su ▪ Toprak ▪ Gök cismi ▪ Bina ▪ Doğal çevre ▪ Yapay çevre	▪ Cumhuriyet ▪ Teknolojik ürün ▪ Bilgisayar ▪ İletişim teknolojisi ▪ Yerleşim birimi ▪ Müze ▪ Kültürel değer ▪ Karşılıklı bağımlılık ▪ Karşılıklı etkileşim ▪ Cansız varlık ▪ Zaman ▪ Doğa ▪ Su döngüsü ▪ Grafik ▪ Meteoroloji ▪ Tahmin ▪ Ay ▪ Süreklilik

Temalara ve sınıflara göre belirlenen bu kavramların derslerde doğrudan doğruya tanımını yapmak yerine, kavramla ilgili kazanımlara ait öğrenme-öğretme etkinlikleri sırasında ve sonrasında öğrenciler tarafından bulunması sağlanacaktır.

Bu Çöpleri Ne Yapalım?

Yaşadığımız çevrenin temiz olduğunu düşünüyor musunuz? Neden?

Ahmet'in babası apartman yöneticisiydi. Bu ay yapılan toplantıda apartman ve çevresinin temizliği için bazı kararlar alındı. Toplantı sırasında onları dinleyen Ahmet, konuyla ilgili fikirlerini babasına anlattı. Bakalım Ahmet ile babası neler konuşmuşlar?

Ahmet: Babacığım, çöpleri bir poşette toplamak sorunumuzu çözmez. Cam, metal ve kâğıt atıklarını ayrı ayrı toplamalıyız. Geçenlerde Bilim Çocuk dergisinde "Doğa Dostu DVD" başlıklı bir yazı okudum.

Japonlar mısır koçanları ve kabuklarından DVD yapmışlar.

Biz de geri dönüşüme katkıda bulunabiliriz.

Baba: Diyelim ki biz çöplerimizi ayrı ayrı poşetlerde topladık. Bunları geri dönüşüm fabrikalarına nasıl ulaştıracağız?

Ahmet: Ben bu konuyu araştırdım. Bazı belediyelerin bu işi yaptığını öğrendim. Biliyor musun baba, bir ton atık kâğıt yirmi tane ağacın kesilmesini önlüyormuş. Atık malzemeleri değerlendirmek hem hava kirliliğini hem de su kirliliğini azaltıyormuş.

Baba: Peki o zaman, ben belediyenin bu konuyla ilgili birimleriyle iletişime geçerim.

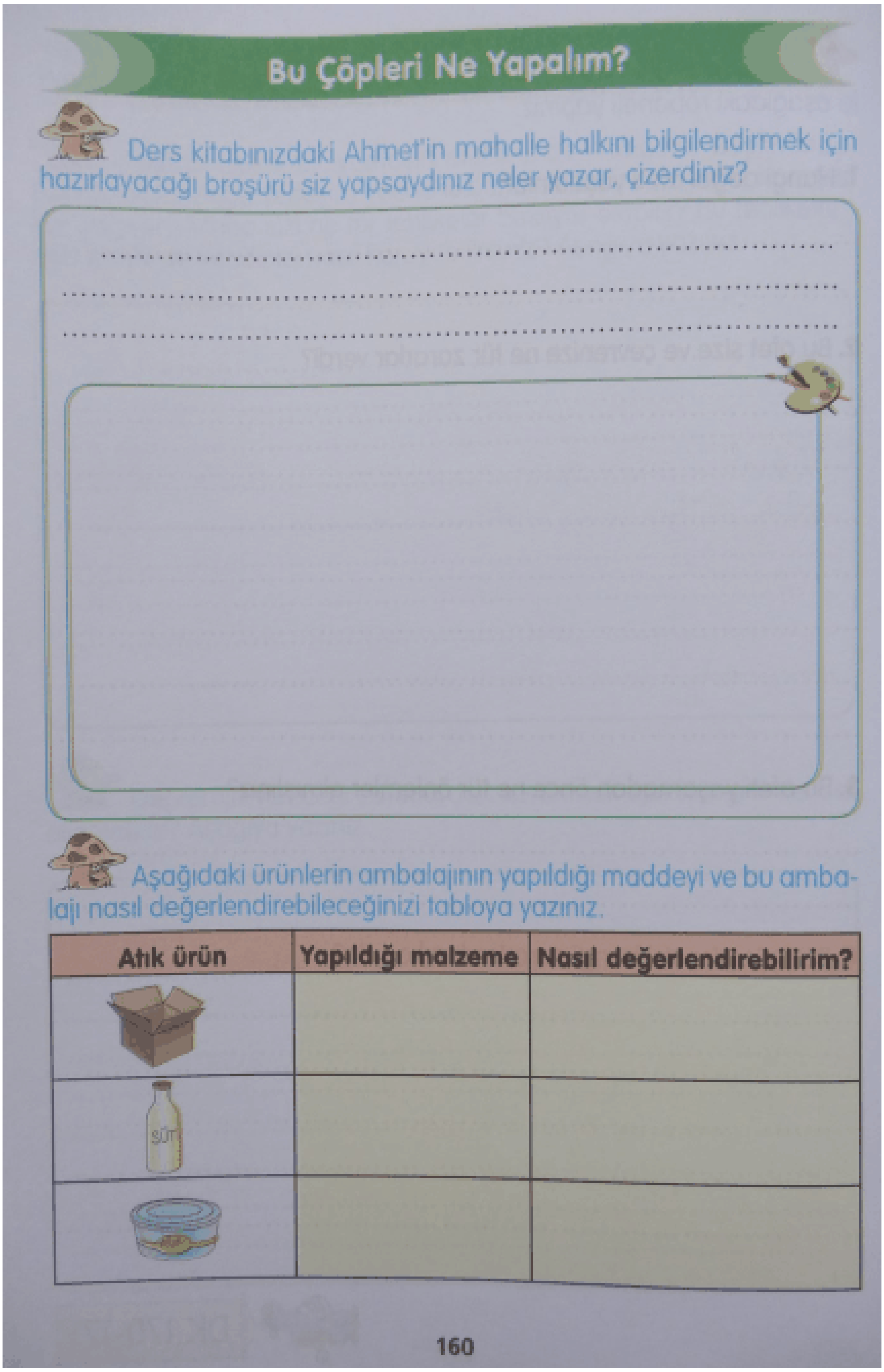
Ahmet: Ben de arkadaşlarımla birlikte broşür hazırlarım. Geri dönüşümün önemini ve ne yapacağımızı broşüre yazarız. Fotokopiyle çoğaltır, mahallede herkesin görebileceği yerlere asarız. Projemiz yaşadığımız çevrenin daha temiz olmasına katkıda bulunacak.

DEĞERLENDİRME

* Siz çevrenizi daha temiz hâle getirmek için neler yapabilirsiniz?
* Çevrenizi daha temiz hâle getirmek için kimlerle iş birliği yapıyorsunuz?

172 ÇK 160-161

Resim-1: Hayat Bilgisi Ders Kitabı, 172. sayfa.



Bu Çöpleri Ne Yapalım?

Ders kitabınızdaki Ahmet'in mahalle halkını bilgilendirmek için hazırlayacağı broşürü siz yapsaydınız neler yazar, çizerdiniz?

....

....

....

Aşağıdaki ürünlerin ambalajının yapıldığı maddeyi ve bu ambalajı nasıl değerlendirebileceğinizi tabloya yazınız.

Atık ürün	Yapıldığı malzeme	Nasıl değerlendirebilirim?
SÜT		

160

Resim-2: Hayat Bilgisi Çalışma Kitabı, 160. sayfa.

Resim-3. Hayat Bilgisi Çalışma Kitabı, 161. sayfa.

APPENDIX B: SAMPLE INSTITUTIONAL RECYCLING WORKS

The Program of Virginia Recycling Association
www.vrarecycles.org

In the US, a guide for a school recycling program is prepared by Virginia Recycling Association. The program emphasizes that reduce-reuse-recycle are the key components to a comprehensive school waste reduction program. The guide has 5 steps to expand recycling in schools. Step 1 is "doing the homework" which includes forming a team, analyzing the trash (generation, composition, and recyclable %), establishing a goal, and getting approval. Step 2 is "the collection system" which is on mapping the school (Figure 1) with relevant logistics, containers, and transportation. Subsequently, steps 3, 4, and 5 cover "education/promotion", "beginning recycling", and "evaluating the program". The guide also covers the outcomes like reduction of waste, extending materials' useful life, saving energy, saving natural resources, and reducing pollution, with numeric data to show the difference that recycling does.

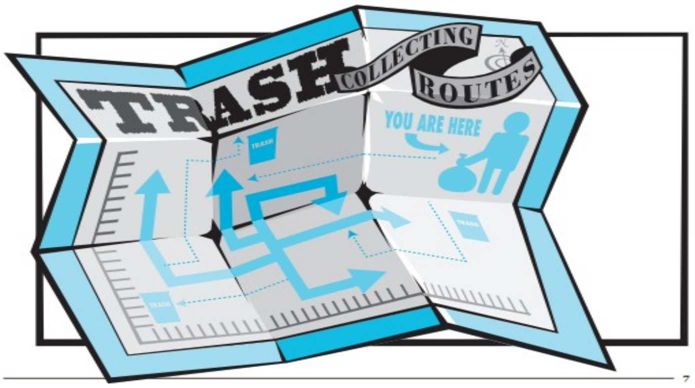


Figure 1. The handout of school mapping activity for recycling.

The Program of City of Tucson
www.tucsonaz.gov/files/es/TTT_Complete_Aug2013.pdf

Again in the US, City of Tucson's middle school recycling program, Talking Trash, provides practical knowledge and skills for increasing participation, reducing contamination, and generating an environmental ethic via engaging activities. The curriculum contains 4 units. In the first unit, "managing solid waste", students participate in a discussion on solid waste management in Tucson, work in small groups to estimate the lifetimes of certain landfill items, share ways to reduce, reuse, recycle, and compost, and write a letter to the editor about waste management practices. In "what we can recycle" unit, students learn about what is recycable and review methods of source reduction, then conduct an inventory of items found in a home refrigerator and determine ways to reduce the amount of garbage they produce. In "using recycled materials" unit, students select a recycable material and research the path by which it becomes a new, usable product, and close the loop. And lastly, in "taking action", students make posters to inform the Tucson community about the importance of recycling and submit their posters to the "Look What's New with Do More Blue" poster contest (Figure 2), sponsored by City of Tucson Environmental Services.

Figure 2. The poster contest notice of Tucson Environmental Services.

The Program of Cornwall Council
www.cornwall.gov.uk/environment-and-planning/recycling-rubbish-and-waste

In the UK, Cornwall Council composed an Environment and Planning Unit within its structure, with the Cory Environmental Company, and formed an official web site. The site covers the pages “when is my rubbish and recycling collected”, “learn more about waste and recycling”, “business waste and recycling”, “household waste and recycling”, and many other, published with cartoon characters (Figure 3). The easy-to-use and frequently updated pages contain informative boxes as; what and where to recycle, what can and can’t be collected, how much waste is collected and where it goes, and how to deal with garden waste. The pages also has a comprehensive “frequently asked questions” part.

Figure 3. The main character of Cornwall Council’s web page.

The Program of Earth Day Canada
www.ecokids.ca

Earth Day Canada’s educational program, EcoKids, offers curriculum-linked materials and activities for elementary schools to engage in environmental action. Their interactive web site for children, families, and educators offers information about the environment through interactive, fun, and educational games and activities to increase participants' willingness to learn, and understand the impact of their own actions on the environment. The main page has links to “games and activities”, “homework help”, “eco-reporters”, and “have your say” parts. In “games and activities” part, wildlife, climate change, energy, the north, water, waste, land use, and first nations are covered. Waste topic in this part contains the games "yard sale", "I don't want to clean my room", "the great garbage caper", "trash troopers", and "the amazing recycling machine" (Figure 4). In the "homework help" part, battery recycling, biodiversity, climate change, earth day, energy, first nations, forests, land use, the north, oceans, renewable energy, and waste are covered. The waste topic in this part contains the tutorial "it is not waste until you waste it" about what the waste is, its problem, and its solution. In the "eco-reporters" part, students are encouraged to become a reporter of the online newspaper by writing articles or sharing videos. The "have your say" part, children are encouraged to think and share their opinions and comments about environmental issues with kids around the world. In this part, every few weeks, a new question from a kid about an environmental issue, animals, science or nature is posted, and an open form with icons is used to find out what children think about it, and get their comments.

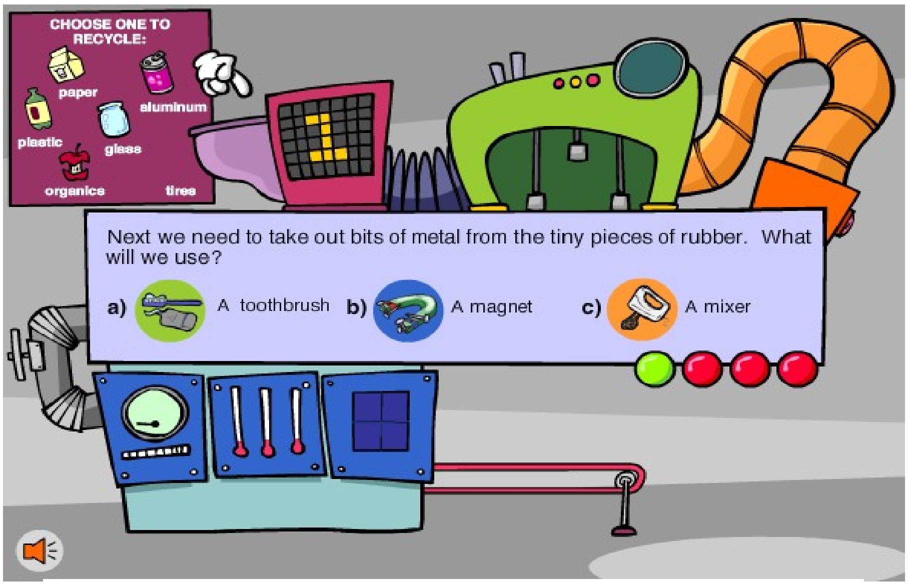


Figure 4. A step from the game "Amazing Recycling Machine".

The Program of Çevko
www.cevko.org.tr

In Turkey, Çevko "Environmental Protection and Solid Waste Utilizing Foundation", performs an educational website for children, named as ÇevkoKid. The intro of the site has the characters; glass bottle, plastic bottle, juice cartoon, juice can, and cartoon box (Figure 5), giving basic information on recycling of themselves. The main page of the site consists of the boxes "what can we recycle", "why recycling is important", "how recycling is implemented", and "our environment and its problems". Accompanying pages have links to online library, online course, and teachers' room. Online library contains two e-books; "Regain" for 1st and 2nd grades, and "Solid Wastes" for 3rd, 4th, and 5th grades. The books contain basics of recycling and relevant activities for children together with three animated characters; Çevki (the cat), Toprak (the boy), and Su (the girl). The site also includes a video part, consisting of an animation film and TV ads. The plot of the animation film is the transformation of the agents for a private missions; Agent P (plastic) into a coat, Agent M (metal) into a bicycle, Agent C (glass) into a jar, and Agent K (cartoon) into a notebook.

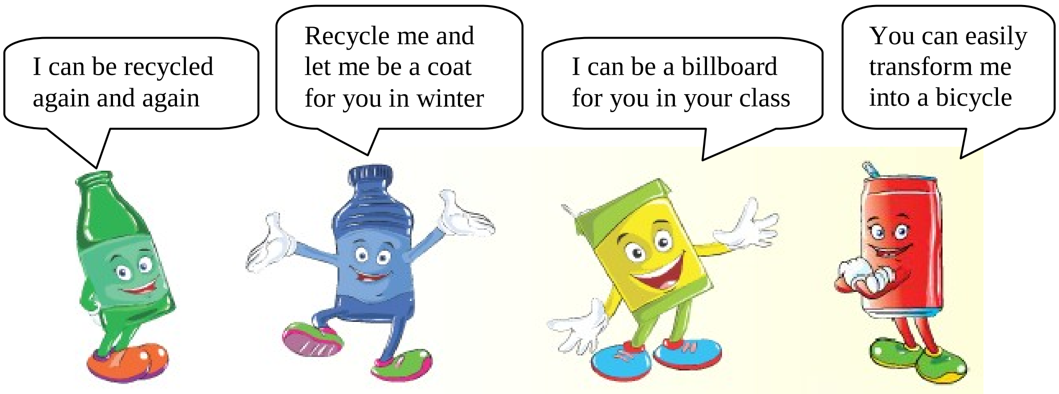


Figure 5. The introductory waste characters of "Çevko Kids" page.

Recycling Concept in Movie Industry: WALL-E and Toy Story

Recycling concept is also covered in recent Hollywood animation works, where the movies WALL-E (2008) and Toy Story 3 (2010) can be considered as the two representative products among these (www.imdb.com/title/tt0910970 and www.imdb.com/title/tt0435761)

The story of "WALL-E" is based on a robot (Fig. 7) designed to clean up the waste-covered Earth far in the future. In 2805, Earth is covered with garbage due to decades of mass consumerism facilitated mainly by the megacorporation, Buy 'n' Large (BnL). In 2105, BnL evacuates Earth's population in habitable spacecrafts, leaving behind trash compactor robots to clean the planet. Eventually BnL abandons its plan and shuts down these robots, except for one which manages to remain active by repairing himself using parts from other units. Apart from his regular duties, he collects artifacts of human civilization and keeps them in his home, a storage truck. He falls in love with another robot named EVE, who also has a programmed task, and follows her into outer space on an adventure that changes the destiny of both his kind and humanity. Both robots exhibit an appearance of free will and emotions similar to humans, which develop further as the film progresses. At the end, WALL-E and EVE happily come together as the humans and robots begin to restore Earth and its environment. The film is seen as a critique on larger societal issues. It addresses consumerism, waste management, environmental problems, the immense impact humans have on the Earth, nostalgia, and risks to human civilization and its home planet Earth.

Figure 6. The animated robot character WALL-E, designed to clean up the Earth.

In the 3rd episode of “Toy Story”, Andy, leaving the home for college, had to leave all his toys, putting them into a bag to be stored in the attic, where the bag is mistakenly taken to for garbage pickup. The toys escape and reach to another house but after some unfortunate happennings, they are collected by a garbage truck. The truck deposits the toys at a dump, where they find themselves on a conveyor belt leading to an incinerator. Here, certain steps of recycling process is highlighted through the script. Firstly, when the toys reach to the factory they are poured onto a garbage heap, which later is moved on a sliding conveyor belt. The belt passes through a tunnel where first metals are removed by magnetic plates, and then the cutters take part, before they are directed to an incinerator. In the movie, surprisingly, the toys are rescued by the Aliens operating an industrial claw, leading to a happy ending.

Figure 7. Toy Story’s main toy character Woody, sliding down to the incinerator.

Recycling Concept in Toy Industry: Lego

Starting in the 1950s, the Lego Group has released hundreds of sets with a variety of themes, including the city, castles, and space. The sets consist of colorful interlocking plastic bricks, which can be connected in many ways, accompanying various mini equipments and mini figures. In the city theme, sets are based on the city life, with models representing main units of the city, such as police, fire, emergency, construction, transport, and other civilian services. Upon these, waste and recycling concept is continuously being used since 2007, in common with the recycling symbol.

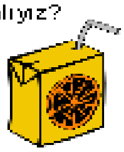
Figure 8. The Recycling Truck set #4206 of Lego, released in 2012.

APPENDIX C: PAGES OF THE INSTRUCTIONAL SOFTWARE

- Sence bu resimler ne ile ilgili?

……………………………………………

- İçi bitmiş bir meyve suyu paketini nereye atmalıyız?



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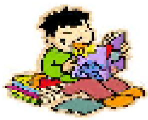
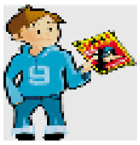
- Okuyup bitirdiğin bir kitabı veya dergiyi ne yaparsın?





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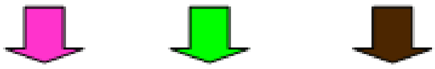
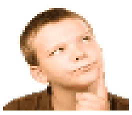
Atmayı düşündüğümüz herşey için 3 seçenek vardır



Yeniden kullanmak | Geri-dönüşüme göndermek | Çöpe atmak

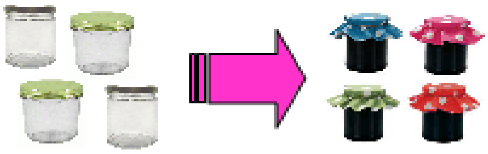
YENİDEN KULLANMAK

- Atmayı düşündüğün ama tekrar kullanılabilecek bir şey ne olabilir?



………………………………………………………

- Mesela, boşalmış kavanozları yeniden kullanabiliriz.



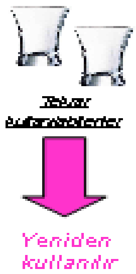
- Bitirdiğimiz kitap ve dergileri başka arkadaşlarımızla paylaşabiliriz.

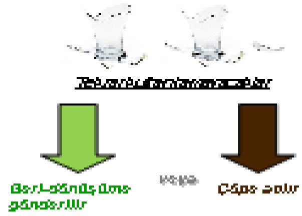
- Giyeceklerimizi ihtiyacı olan yaşıtlarımıza verebiliriz.

- Kullanılmış eşyaların bazıları böyle yeniden kullanılabilir…

- Ama herşey yeniden kullanılamaz.

- Onları ya geri-dönüşüme göndeririz, ya da çöpe atarız.





GERİ DÖNÜŞÜM ve ÇÖP

- Kullanılmış ve bir daha aynı şekilde kullanılmayacak maddelere "ATIK" denir.

- Bazı atıklar çeşitli işlemlerle yenilenerek kullanılabilirler.

- Ama bazıları hiçbir şekilde yenilenerek kullanılamaz. İşte bu atıklara "ÇÖP" denir.

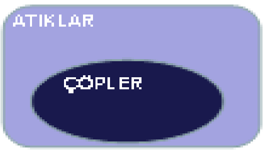
- Bu nedenle, sağlam veya yenilenebilir atıklar çöpe atılmamalıdır..!

- Çünkü çöpe atılan atıklar bir daha kullanılamaz.

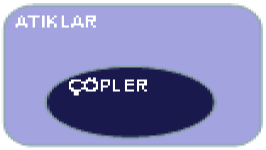
Buna göre aşağıdaki şekillerden hangisi doğru?
A mı, B mi?

A

B



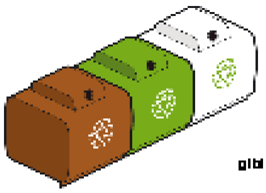
CEVAP: Attığımız herşey atıktır.
Çöpler bu atıkların bir parçasıdır.



- Değerlendirilebilir atıkların bazı işlemlerle kullanılır hale getirilmesine *"geri dönüşüm"* denir.

- Sence hangi atıklar geri dönüşüm için uygundur? Aklına gelen birkaçını yazabilir misin?

……………… ………………
……………… ………………
……………… ………………



- Kağıt,
- Plastik,
- Metal,
- Cam,
- Pil,
- Yemek artıkları,
- Kızartma yağları,
- Motor yağları,
- İnşaat atıkları

gibi birçok madde geri dönüştürülebilir.

Ama gündük hayatta bizim bunlardan en çok gördüklerimiz "kağıt", "plastik", "metal", ve "cam"dır.

4 kişilik bir evden sence günde kaç kilogram atık çıkar?

…………………

Ülkemizde 1 günde 4 kişilik bir evden 4 kilogram kadar atık çıkıyor.

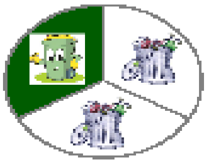
O zaman,
1 kişi 1 günde yaklaşık 1 kg atık üretir.

- O halde, İstanbul gibi 15.000.000 kişilik bir şehirden çıkan atık miktarı günde 15.000.000 kg'dır.

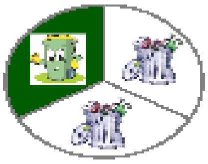
- Sence bu atıkların ne kadarı geri dönüştürülebilir?

  A) hepsi (1/1)
  B) üçte biri (1/3)
  C) beşte biri (1/5)
  D) onda biri (1/10)

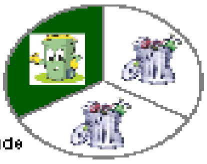
Atıkların hepsi değil, ama yaklaşık 3'te 1'i geri dönüştürülebilir.



(Yani, atıkları 3'e bölersek, bunun 2 parçası çöptür, ama kalan 1 parçası geri dönüşebilir)



SORU: 6 kg atığın ne kadarı geri dönüşebilir?



CEVAP: 6 kg atığın içinde
4 kg çöp,
2 kg geri dönüştürülebilir atık vardır.

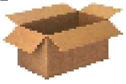
- Sence metal bir kutu doğada ne kadar zamanda yok olur?

……………………

- Cam bir kavanoz doğada ne kadar zamanda yok olur?

……………………

- Karton bir karton kutu doğada ne kadar zamanda yok olur?



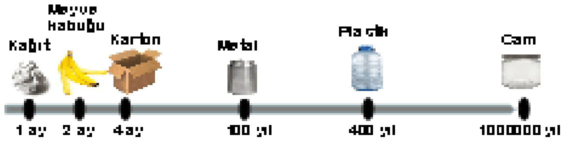
……………………

- Plastik bir şişe ne kadar zamanda yok olur?

……………………

- Bazı malzemelerin doğada çözünerek yok olması <u>çooooook uzun zaman</u> alır.

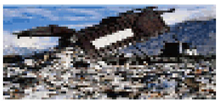
  Bir sonraki sayfaya dikkatle bakalım !



- Atıkların uzun süre doğada kalması doğanın kirlenmesine neden olur.
- Ve içerlerindeki zararlı maddeler "<u>toprağa</u> – <u>havaya</u> – <u>suya</u>" karışır.

- Nefes aldığımız "<u>hava</u>" kirlenir.

- Kullandığımız "<u>toprak</u>" kirlenir.



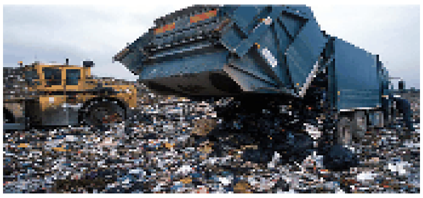
- İçtiğimiz "<u>su</u>" kirlenir.

- Doğadaki hayvanlar çevreye atılan çöplerden <u>zehirlenebilir</u> veya <u>yaralabilirler</u>.

- Şimdi, atıklara neler yapıldığına bakalım …

ATIKLARA NE YAPILIR ?

- Atıklara aşağıdaki 4 işlemden biri yapılır.
  - Depolama
  - Yakma
  - Geri dönüştürme
  - Kompostlaştırma



- <u>Depolama</u>:
  Atıkların önceden hazırlanmış güvenli bir alana yayılması ve toprak tabakalar ile örtülmesidir.

- Yakma :
  Atıklar büyük fırınları olduğu tesislerde yakılır.
  Böylece ısı ve elektrik enerjisi elde edilir.

- Geri dönüştürme :
  Atıkların temizleme, parçalama, ısıtma, soğutma gibi işlemlerle yeni ürünlere dönüştürülmesidir.

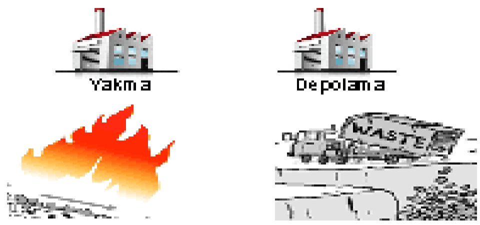
- Kompostlama:
  Yiyecek artıklarına organik atıklar denir. Bu atıklar uygun alanlarda *bakteriler* yardımı ile çözülür.

Mikroskopik derecede küçük canlılar olan *bakteriler*, yiyecekleri sindirirler.
Ve toprağa yararlı su, sıcaklık ve humus haline getirirler.

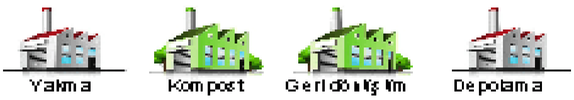
- Çöpler depolanmakta veya yakılmaktadır.
  Bu işlemler doğayı kirletir ve zarar verir.

- Yenilenebilir atıklar ise doğa dostu olan geri dönüşüm veya kompost işlemleriyle geri kazanılmaktadır.

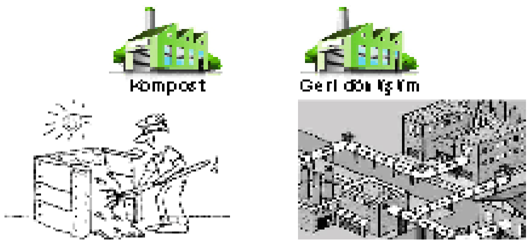
CEVAP: Çöpler ya yakılır, ya da depolanır.
Çünkü çöpler geri dönüşmez !



[illegible]
- "Yakma" tesisi
- "Kompost" tesisi
- "Geri dönüşüm" tesisi
- "Depolama" tesisi



Ama kompost ve geri dönüşüm ile atıkları yeniden kazanırız !

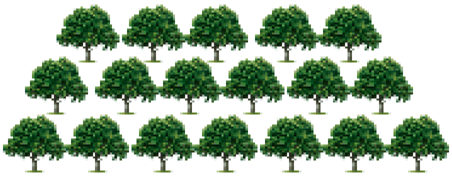


Geri dönüşüm çok önemlidir çünkü;

- *Doğal kaynaklarımızı korur*
- *Enerji tasarrufu sağlar*
- *Çöp miktarını azaltır*
- *Çevre kirliliğini önler*

Doğal kaynaklarımızı korur

- Yeni kağıt üretmek için birçok ağaç kesmek gerekir.
- Ama 1 ton kağıdın geri dönüşümü, 15-20 ağacın kesilmesini önler.



Enerji tasarrufu sağlar

- Örneğin, kullanılmış kağıtlar yerine ağaç keserek kağıt yapmak için çok daha fazla enerji gerekir.

Çöp miktarını azaltır

- Çünkü dikkat etmeden atılan çöplerin arasında çok fazla geri kazanılabilecek atık vardır.

Çevre kirliliğini önler

- Çünkü çöp miktarı azaldığında, kötü koku ve kötü görüntü azalır.
- Çöplerin azalması; havanın, suyun ve toprağın daha temiz kalmasını sağlar.

Şimdi de geri dönüşüm sembolüne bakalım...

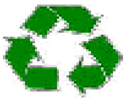
- 1970 yılında (yani bundan 44 yıl önce), geri dönüşüm için bir sembol yarışması yapılmış.

- Bu yarışmada birinciliği *Gary Anderson* isimli bir üniversite öğrencisinin çizdiği sembol kazanmış.

Sence Gary bu sembol ile ne anlatmak istemiş olabilir?

………………………………………………………………

- Bu sembolde, birbirini takip eden <u>3 ok</u> var.
- Bunlar geri dönüşümdeki <u>3 adımı</u> gösteriyor.

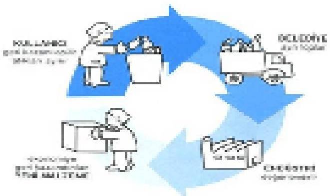


- <u>1. adım:</u> Atıkların toplanması.
- <u>2. adım:</u> Bu atıkların tesislerde işlenerek yeni ürünler haline gelmesi.
- <u>3. adım:</u> Bu yeni ürünlerin kullanılması.

3. adımdan sonra yine 1. adım gelir.
Çünkü kullanılan malzemeler atık olarak yine geri dönüşüm için toplanır.

Kısaca

- Sınıflandırarak toplama
- İşlemden geçirme
- Yenilenen ürünleri kullanma

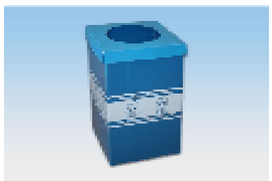


Kağıt, metal, plastik ve camlara benzer işlemler yapılır, <u>ama aralarında bazı farklar vardır</u>.

Bu yüzden, farklı atıkların ayrı ayrı toplanması için farklı renkte kutular vardır.

Ama bazı kutular her tür geri dönüşüm için yapılır.

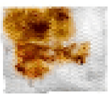
(Sizin sınıfınızdaki kutular gibi)



Sınıftaki kutularda en çok kağıt, karton ve plastik atıklar birikir.

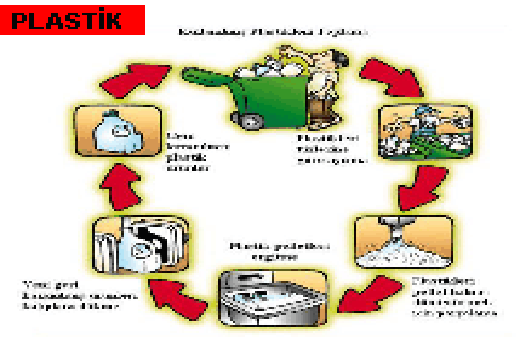
Yalnız, geri dönüşüme sadece yazılı-çizili-buruşuk kağıtları atmalıyız.

Yağlı ve üzerine kirler bulaşmış kağıtları <u>atmamalıyız!</u>

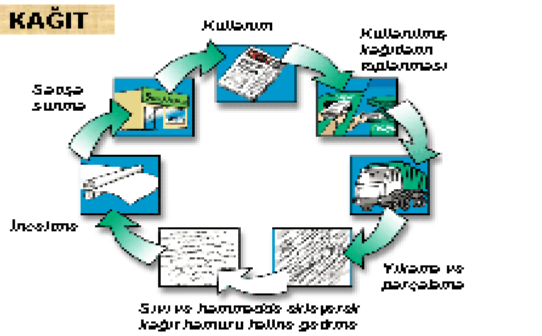


- Son olarak, kağıt, metal, plastik ve camlara geri dönüşüm fabrikalarında neler yapıldığına bakalım…

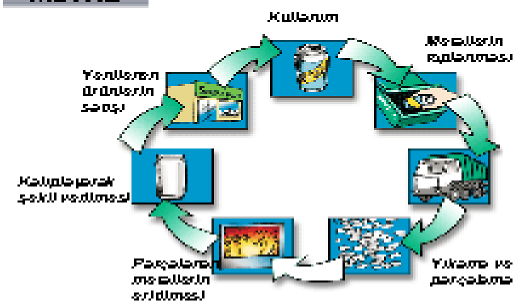
PLASTİK



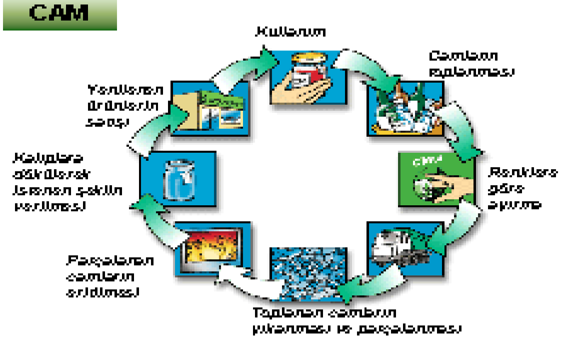
KAĞIT



METAL

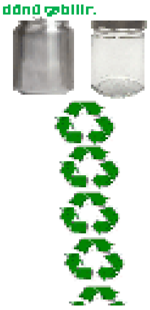


CAM



Kağıt ve plastikler bir defa geri dönüşür.

Ama metaller ve camlar tekrar tekrar dönüşebilir.



Bu işlemlerin birbirine ne kadar benzediğini bir sonraki sayfada görebilirsiniz…

- Lütfen <u>benzerlikleri</u> ve <u>farklılıkları</u> dikkatle inceleyin !

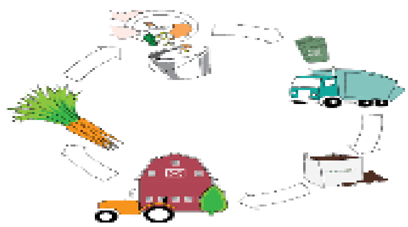
KISACA…

KAĞITLAR ———>

METALLER ———>

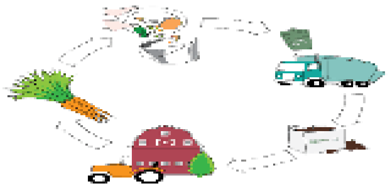
PLASTİKLER —>

CAMLAR ——>



- Son bir soru:

O zaman yukarıda <u>hangi atıkların</u> dönüşümü gösteriliyor?



- Evet, burada yiyecek atıklarının (organiklerin) dönüşümü gösteriliyor.
  Bakteriler bu atıkları toprağa geçiriyor ve toprak daha verimli oluyor.

Geri kazanımda dikkat etmemiz gereken bir nokta da "atık üretimini azaltmak"tır.

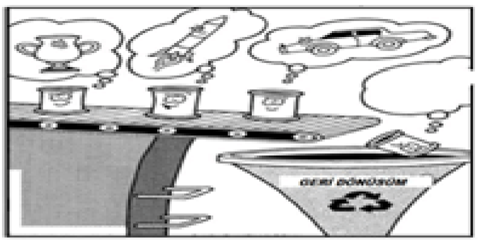
ALIŞVERİŞTE DİKKAT ETMEMİZ GEREKENLER

>> Kat kat paketlenmiş ürünler yerine ambalajı az olan ürünleri seçmeliyiz.

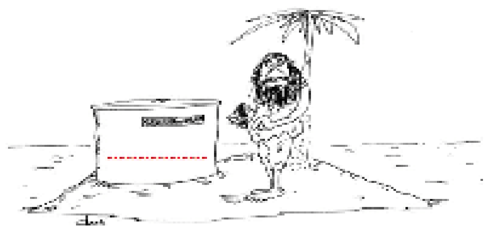
>> İhtiyacımız olmayan ürünleri almamalıyız.

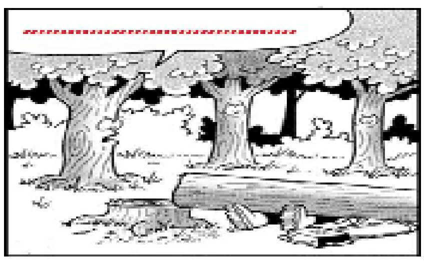
>> Poşetleri daha az kullanmalıyız.

>> Uzun kullanabileceklerimizi seçmeliyiz.

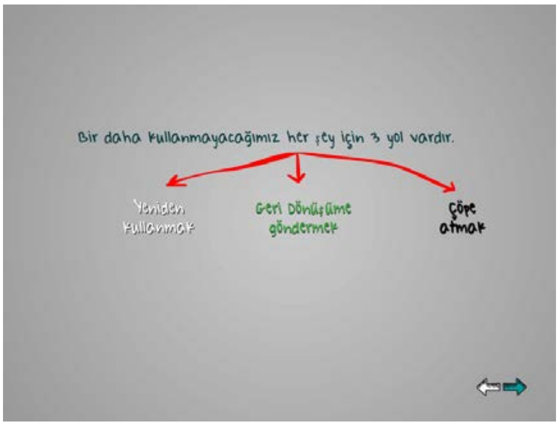


- Karikatürdeki kutulardan mutsuz olan kutu geri dönüşümden sonra ne olacağını düşünüyor olabilir?
  ……………………………

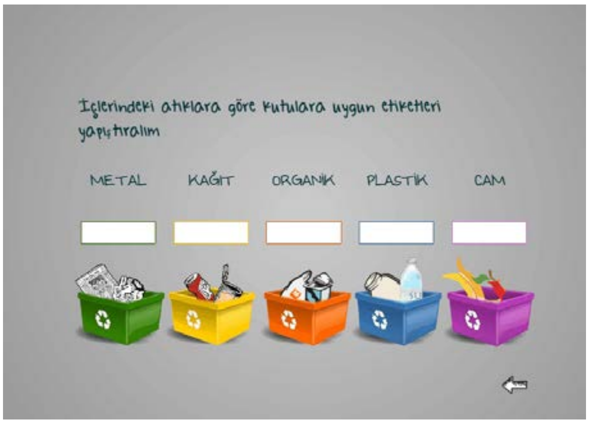




The Recycling Factory Game




Aşağıdaki gördüğün bu farklı atıkları benzerliklerine göre kutulara yerleştirebilir misin?
SU


İçlerindeki atıklara göre kutulara uygun etiketleri yapıştıralım
METAL
KAĞIT
ORGANİK
PLASTİK
CAM


Geri dönüşüm bu işte;
tüm bu tekrar kullanmayacağımız atıkların
yeniden kullanılabilir hale getirilmesi


Bu işaret geri dönüşümün sembolüdür.


Sence bu işaretin neden yuvarlak ve dönen bir şekli var?
A atıklar dönen makinalarda dönüştüğü için
B atıklar çok hızlı bir işlemden geçtiği için
C atıklar önceki hallerine döndüğü için


Sence bu işaretin neden yuvarlak ve dönen bir şekli var?
Çünkü bu dönen okları takip edince başladığımız yere geri döneriz.
Atıklar da geri dönüşüm yoluyla başlangıçtaki hallerine geri dönerler.
Yani, yepyeni birer malzeme olurlar


Sence bu işaretin rengi neden yeşil?
A doğayı koruduğu için
B işaretin daha parlak görünmesi için
C yeşil renkli atıklar geri dönüştüğü için


Sence bu işaretin rengi neden yeşil?
A doğayı koruduğu için
B işaretin daha parlak görünmesi için
C yeşil renkli atıklar geri dönüştüğü için


Sence bu işaretin neden yuvarlak ve dönen bir şekli var?
Doğa yeşil renkle ifade edilir,
geri dönüşüm doğayı koruduğu için işaret yeşildir.

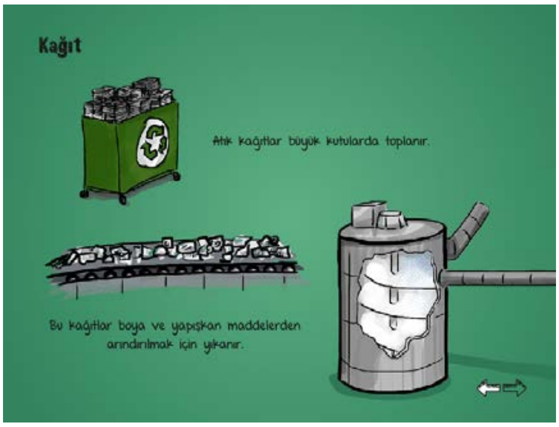

Aşağıdakiler gibi birçok atık geri dönüştürülebilir.
- kağıt -
- plastik -
- metal -
- cam -
- motor yağı -
- elektronik atıklar -
- piller -
- organik atıklar -
- beton -

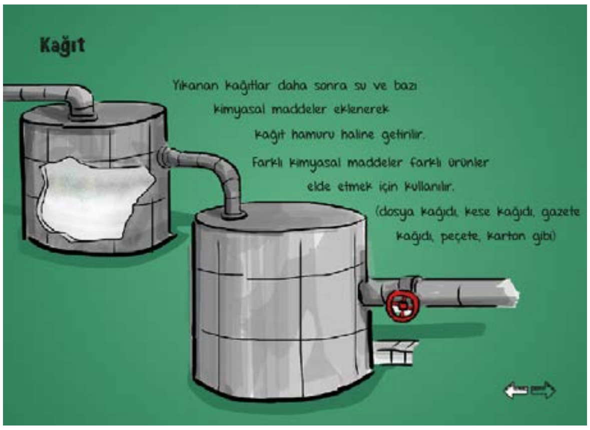

- İyi de ben atıkları nasıl ayıracağımı biliyorum ki zaten
- Asıl merak ettiğim fabrikada ne yapıyorlar?
Bu atıklar nasıl yeniden kullanılabilecek hale geliyor, biraz daha araştırsam iyi olacak!

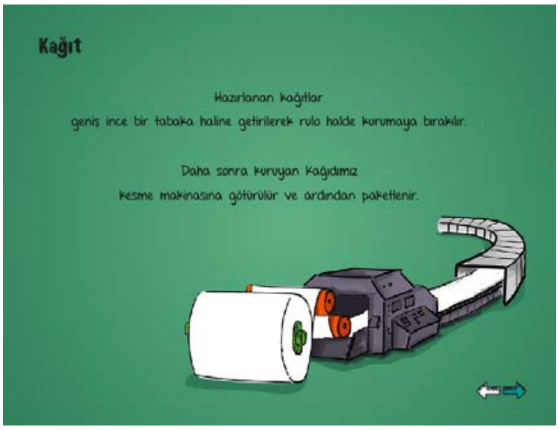

Google


Fabrikada farklı atıklar farklı işlemlerden geçer.
Kağıt
Cam
Metal
Plastik

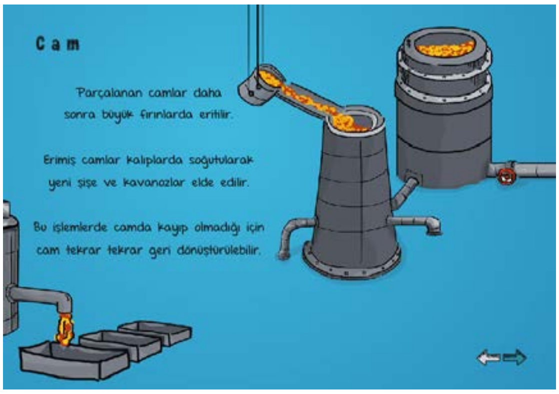

Kağıt
Geri dönüşüm arabaları
kutularda biriken atıkları toplayarak fabrikaya götürür.

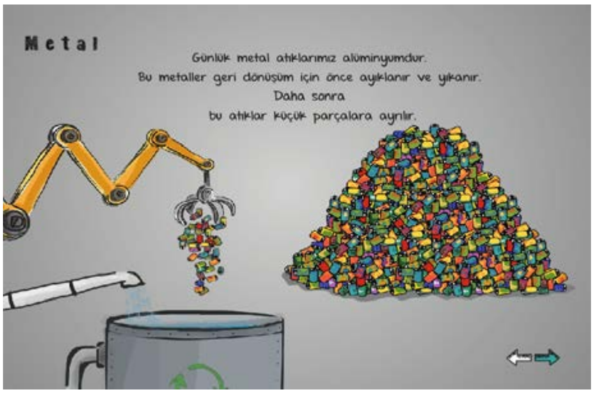

Kağıt
Atık kağıtlar büyük kutularda toplanır.
Bu kağıtlar boya ve yapışkan maddelerden arındırılmak için yıkanır.

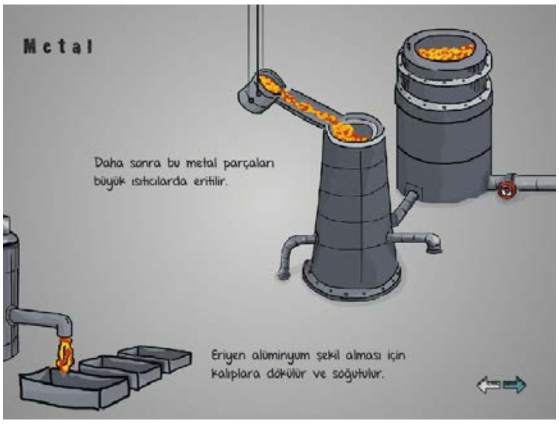

Kağıt
Yıkanan kağıtlar daha sonra su ve bazı kimyasal maddeler eklenerek kağıt hamuru haline getirilir.
Farklı kimyasal maddeler farklı ürünler elde etmek için kullanılır.
(dosya kağıdı, kese kağıdı, gazete kağıdı, peçete, karton gibi)

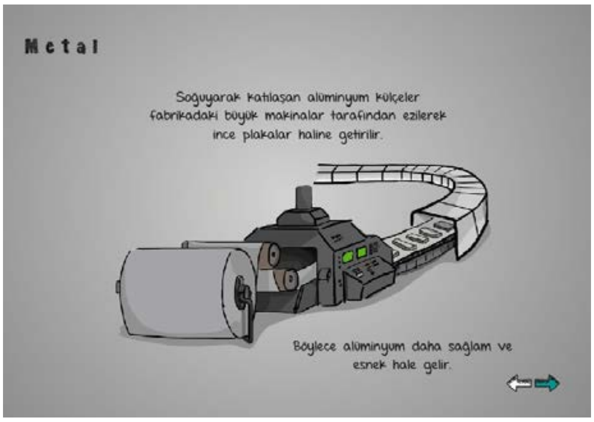

Kağıt
Hazırlanan kağıtlar
genis ince bir tabaka haline getirilerek rulo halde kurumaya bırakılır.
Daha sonra kuruyan kağıdımız
kesme makinasına götürülür ve ardından paketlenir.


C a m
Daha sonra bu camlar parçalanır.


C a m
Parçalanan camlar daha
sonra büyük fırınlarda eritilir.
Erimiş camlar kalıplarda soğutularak
yeni şişe ve kavanozlar elde edilir.
Bu işlemlerde camda kayıp olmadığı için
cam tekrar tekrar geri dönüştürülebilir.

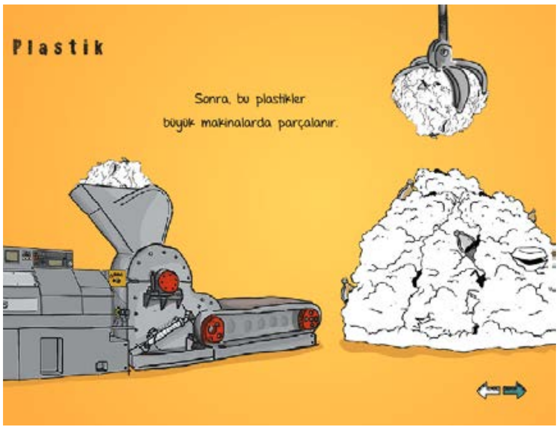

M e t a l
Günlük metal atıklarımız alüminyumdur.
Bu metaller geri dönüşüm için önce ayıklanır ve yıkanır.
Daha sonra
bu atıklar küçük parçalara ayrılır.

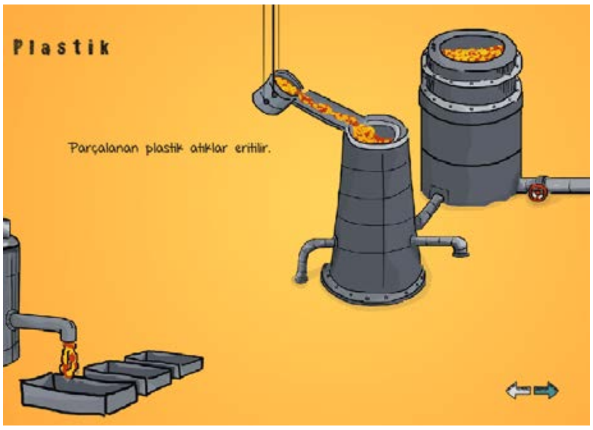

M e t a l
Daha sonra bu metal parçaları
büyük ısıtıcılarda eritilir.
Eriyen alüminyum şekil alması için
kalıplara dökülür ve soğutulur.


M e t a l
Soğuyarak katılaşan alüminyum külçeler
fabrikadaki büyük makinalar tarafından ezilerek
ince plakalar haline getirilir.
Böylece alüminyum daha sağlam ve
esnek hale gelir.


M e t a l
Geri dönüştürülen metaller farklı yerlerde kullanılmak için hazırdır.
İnceltilen alüminyum kutu içeceklerde,
çok inceltilen alüminyum da yiyecek ambalajlarında kullanılır.

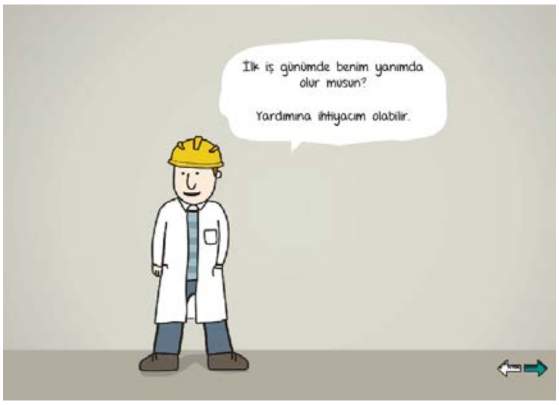

P l a s t i k
Farklı tipteki plastik atıklar sınıflarına göre ayrılırlar.
Pet şişe, plastik tabak, plastik boru gibi..
Sınıflandırılan plastik atıklar yabancı
maddelerden arındırılmak için yıkanır.

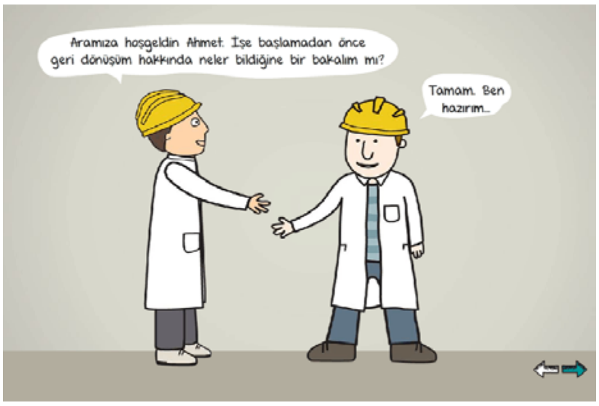

Plastik
Sonra, bu plastikler büyük makinalarda parçalanır.


Plastik
Parçalanan plastik atıklar eritilir.


Plastik
İşlemden geçirilerek tekrar soğutulan plastikler yeni ambalaj ve malzeme ürünleri olmak için hazırdır.

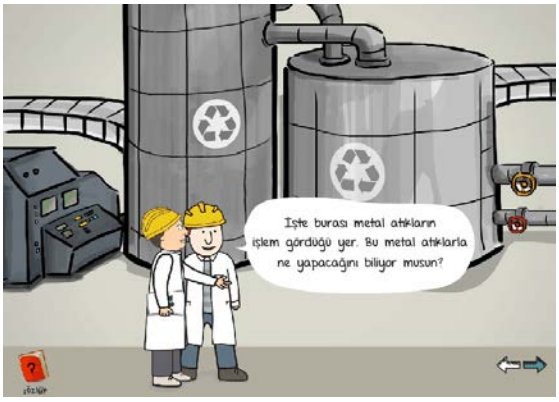

Artık başlamaya hazırım.
Yarın işe gittiğimde herkesi şaşırtacağım.
Görüşürüz...


İlk iş günümde benim yanımda olur musun?
Yardımına ihtiyacım olabilir.


Aramıza hoşgeldin Ahmet. İşe başlamadan önce geri dönüşüm hakkında neler bildiğine bir bakalım mı?
Tamam. Ben hazırım...

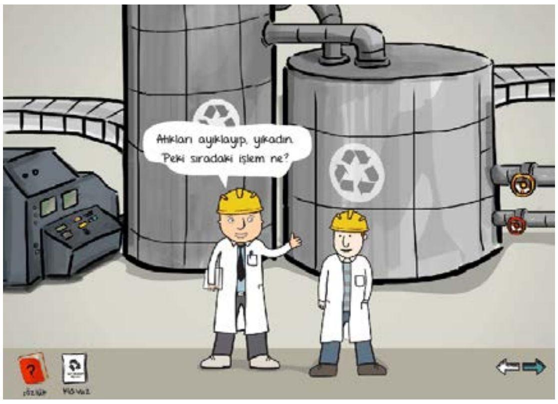

Bakalım buradaki atıkları uygun şekilde ayırabilecek misin?
KAĞIT
METAL
PLASTİK
CAM
ORGANİK


Harika tüm atıkları ayırmışsın. Ama bizim işimiz bundan biraz daha farklı.
Bakalım ayırdığın bu atıkların nasıl bir işlemden geçmesi gerektiğini biliyor musun?


İşte burası metal atıkların işlem gördüğü yer. Bu metal atıklarla ne yapacağını biliyor musun?


Metal atıklara ilk olarak uygulanacak işlem nedir? (Doğru cevaba tıkla)
Boyayacağım.
Yıkayacağım.

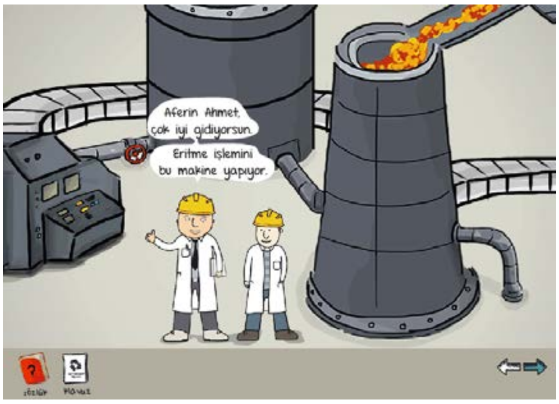

Hadi yıka o zaman!

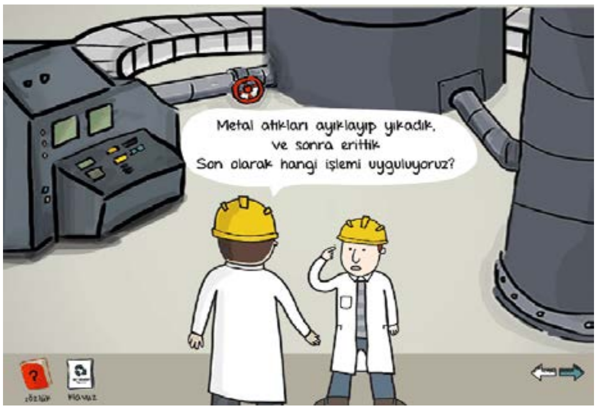

Atıkları ayıklayıp, yıkadın. Peki sıradaki işlem ne?


Metal atıklar ayıklandı ve yıkandı. Sıradaki işlem nedir? (Doğru cevaba tıkla)
Parçalayacağım.
Parlatacağım.

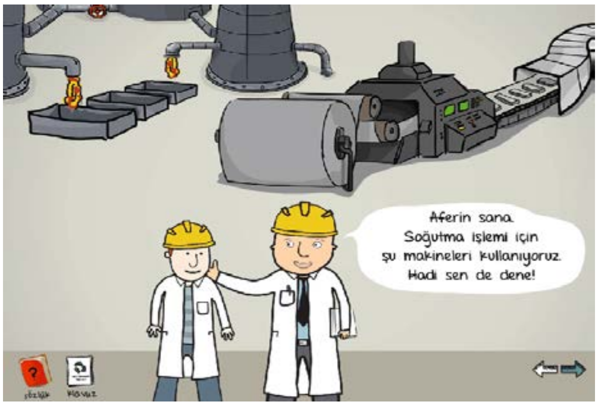

Metaller burada parçalanıyor. Sonra ne yapıldığını biliyor musun?


Metal atıklar ayıklandı, yıkandı ve son olarak parçalandı. Sıradaki işlem nedir? (Doğru cevaba tıkla)
Eriteceğim.
Donduracağım.


Aferin Ahmet, çok iyi gidiyorsun.
Eritme işlemini bu makine yapıyor.


Metal atıkları ayıklayıp yıkadık, ve sonra erittik. Son olarak hangi işlemi uyguluyoruz?


Metal atıklar ayıklandı, yıkandı parçalandı ve son olarak eritildi. Sıradaki işlem nedir? (Doğru cevaba tıkla.)
Erimiş halde saklıyoruz.
Kalıplara döküp soğutuyoruz.


Aferin sana. Soğutma işlemi için şu makineleri kullanıyoruz. Hadi sen de dene!

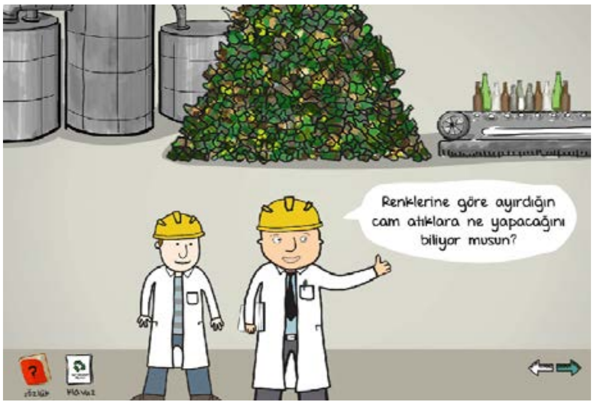

Fabrikamıza gelen metallerle bu geridönüşümün sonunda sence bunlardan hangisini elde edebiliriz?
Çekiç
Top
Kavanoz


CAM ATIK BÖLÜMÜ
Metal atıkların geri dönüşümünü biliyormuşsun.
Peki cam atıkların nasıl geri dönüştürüldüğünü biliyor musun bakalım.


İşte burası cam atıkların işlem gördüğü yer. Camlara ilk ne yapıldığını biliyor musun?


Cam atıklara ilk olarak uygulanacak işlem nedir? (Doğru cevaba tıkla.)
Parçalayacağım.
Renklerine göre ayıracağım.

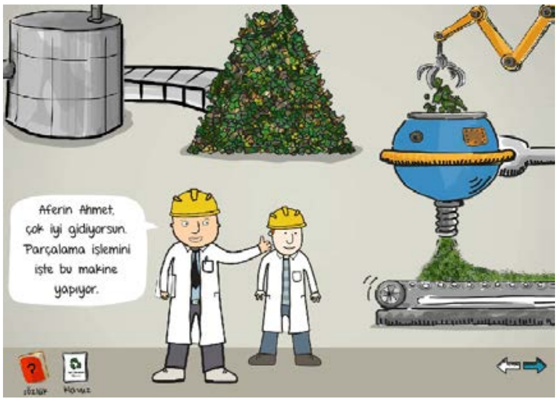

Hadi ayır o zaman!


Renklerine göre ayırdığın cam atıklara ne yapacağını biliyor musun?


Cam atıkları renklerine göre ayırdın. Şimdi ne yapacaksın?
(Doğru cevaba tıkla.)
Hepsini aynı renge boyayacağım.
Yıkayacağım.

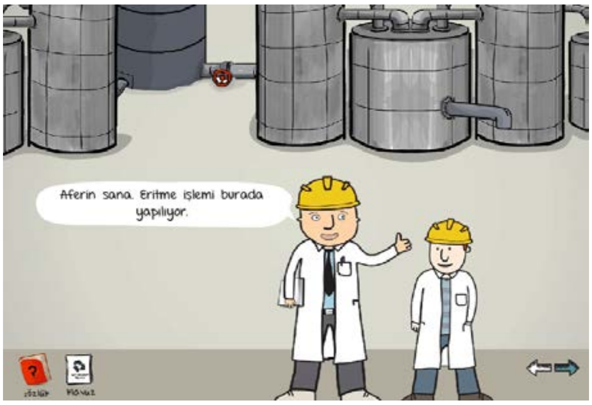

Cam atıkları önce ayırdık, sonra temizledik. Şimdi ne yapacaksın Ahmet?


Cam atıkları önce renklerine göre ayırdın, sonra üzerindeki etiketleri ve yabancı maddeleri temizledin. Şimdi ne yapacaksın? (Doğru cevaba tıkla.)
Parçalayacağım.
Parlatacağım.

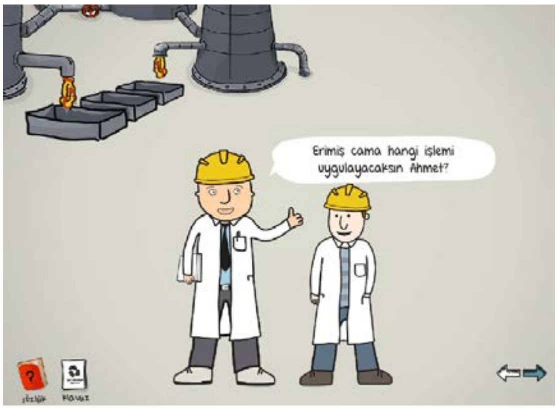

Aferin Ahmet, çok iyi gidiyorsun. Parçalama işlemini işte bu makine yapıyor.


Camları önce yıkadık, sonra parçaladık. Daha sonra ne yapıyoruz?

Cam atıkları önce ayırıp yıkıyoruz, sonra parçalıyoruz. Son olarak parçalanmış camlara hangi işlemi uyguluyoruz? (Doğru cevaba tıkla.)
Birbirine yapıştıracağım.
Eriteceğim.

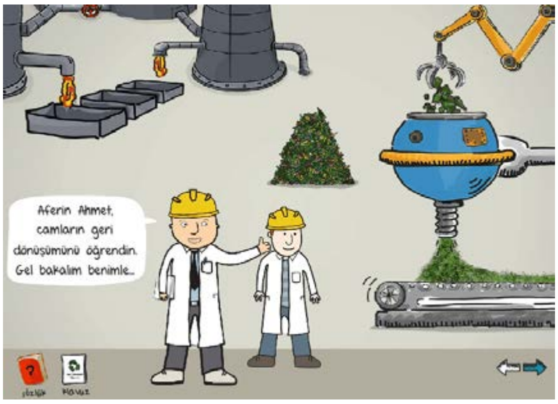


Aferin sana. Eritme işlemi burada yapılıyor.



Erimiş cama hangi işlemi uygulayacaksın Ahmet?

Cam atıkları renklerine göre ayırdın ve erittin. Şimdi ne yapacaksın? (Doğru cevaba tıkla.)
Erimiş halde saklıyoruz.
Kalıplara döküp soğutuyoruz.



Aferin Ahmet, camların geri dönüşümünü öğrendin. Gel bakalım benimle...

KAĞIT ATIK BÖLÜMÜ
Metal ve cam atıkların geri dönüşümünü biliyormuşsun.
Peki kağıt atıkların nasıl geri dönüştürüldüğünü biliyor musun?

İşte burası kağıt atıkların işlem gördüğü yer. Bu atıklarla ilk olarak ne yapacağını biliyor musun?

Kağıt atıklara ilk olarak uygulanacak işlem nedir? (Doğru cevaba tıkla.)
Parçalayacağım.
Bir kutu içinde saklayacağım.

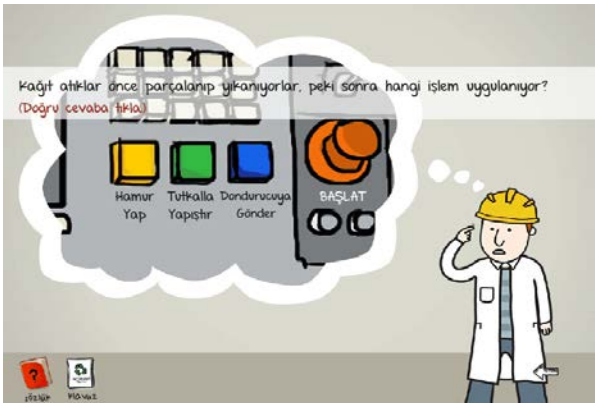

Evet, kağıt atıkları öncelikle parçalıyoruz.
Peki sonra ne yapıyoruz?


Kağıt atıklar parçaladıktan sonra hangi işlemi uyguluyoruz?
(Doğru cevaba tıkla.)
Boyayacağım.
Yıkayacağım.


Hadi yıka o zaman!

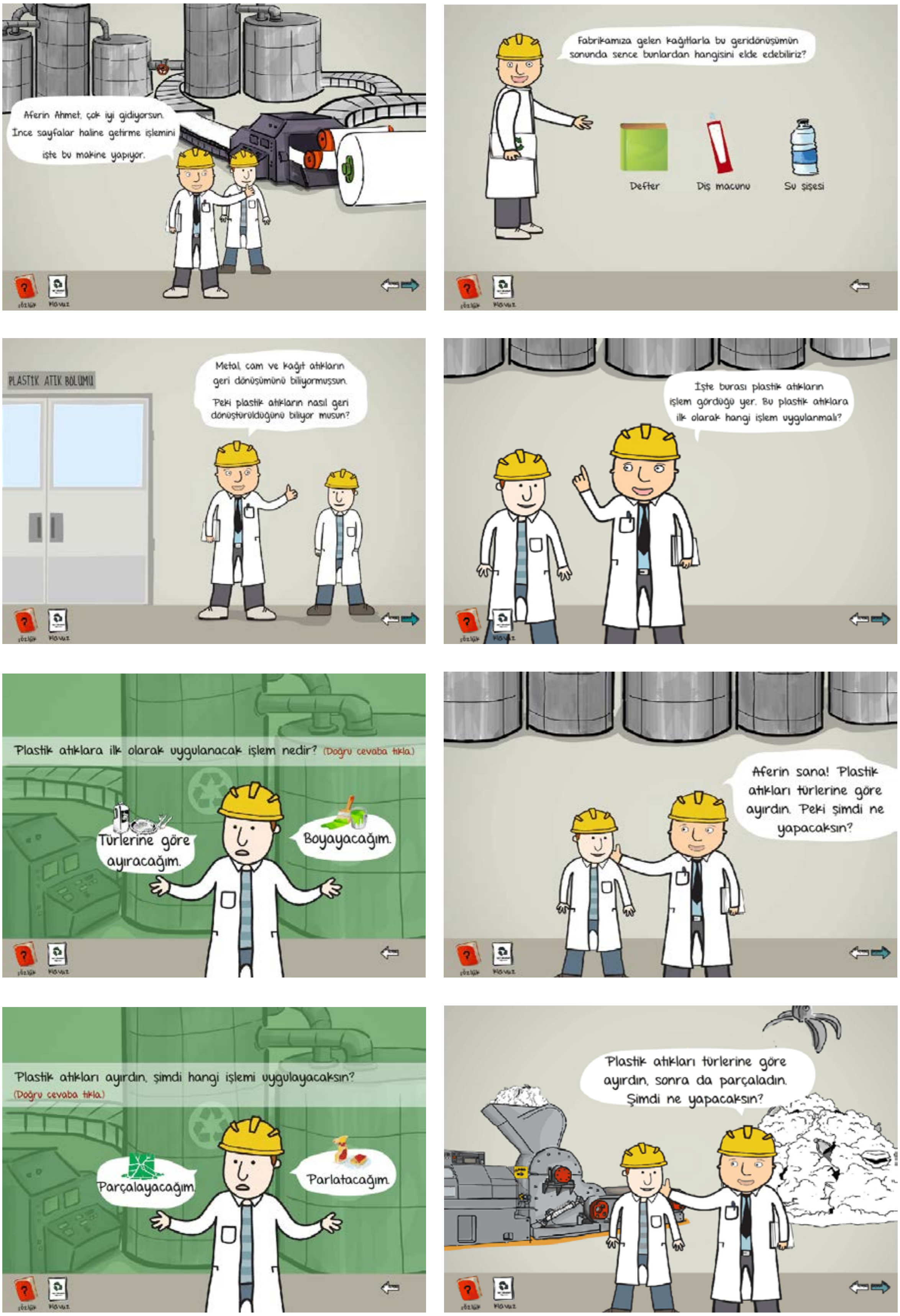

Kağıt atıklar şimdi sonraki işlem için temizlenip yıkanıyorlar.


Bir sonraki işlemi şuradaki makine yapıyor.
Hangi işlemi yapacağını biliyorsan doğru düğmeye basman yeterli.

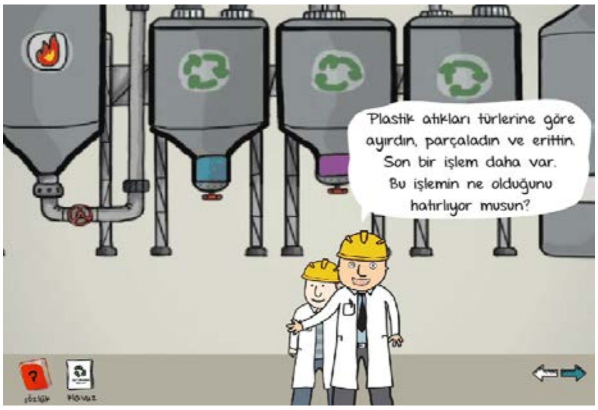

Kağıt atıklar önce parçalanıp yıkanıyorlar, peki sonra hangi işlem uygulanıyor?
(Doğru cevaba tıkla.)
Hamur Yap
Tutkalla Yapıştır
Dondurucuya Gönder
BAŞLAT


Kağıt atıkları önce yıkadın, sonra hamur haline getirdin. Şimdi ne yapacaksın Ahmet?

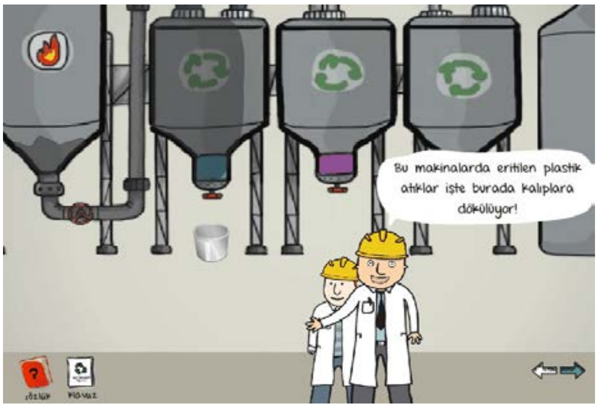

Kağıt atıklarları önce parçaladın, yıkadın, sonra hamur haline getirdin. Sıradaki işlem nedir? (Doğru cevaba tıkla.)
İnceltip rulo yapacağım.
Bir kutu içinde saklayacağım.


Aferin Ahmet, çok iyi gidiyorsun.
İnce sayfalar haline getirme işlemini
işte bu makine yapıyor.
Fabrikamıza gelen kağıtlarla bu geridönüşümün sonunda sence bunlardan hangisini elde edebiliriz?
Defter
Diş macunu
Su şişesi
PLASTİK ATIK BÖLÜMÜ
Metal, cam ve kağıt atıkların geri dönüşümünü biliyormuşsun.
Peki plastik atıkların nasıl geri dönüştürüldüğünü biliyor musun?
İşte burası plastik atıkların işlem gördüğü yer. Bu plastik atıklara ilk olarak hangi işlem uygulanmalı?
Plastik atıklara ilk olarak uygulanacak işlem nedir? (Doğru cevaba tıkla)
Türlerine göre ayıracağım.
Boyayacağım.
Aferin sana! Plastik atıkları türlerine göre ayırdın. Peki şimdi ne yapacaksın?
Plastik atıkları ayırdın, şimdi hangi işlemi uygulayacaksın?
(Doğru cevaba tıkla)
Parçalayacağım.
Parlatacağım.
Plastik atıkları türlerine göre ayırdın, sonra da parçaladın. Şimdi ne yapacaksın?


Parçalanan plastik atıklara şimdi hangi işlem uygulanacak?
(Doğru cevaba tıkla.)
Donduracağım.
Eriteceğim.

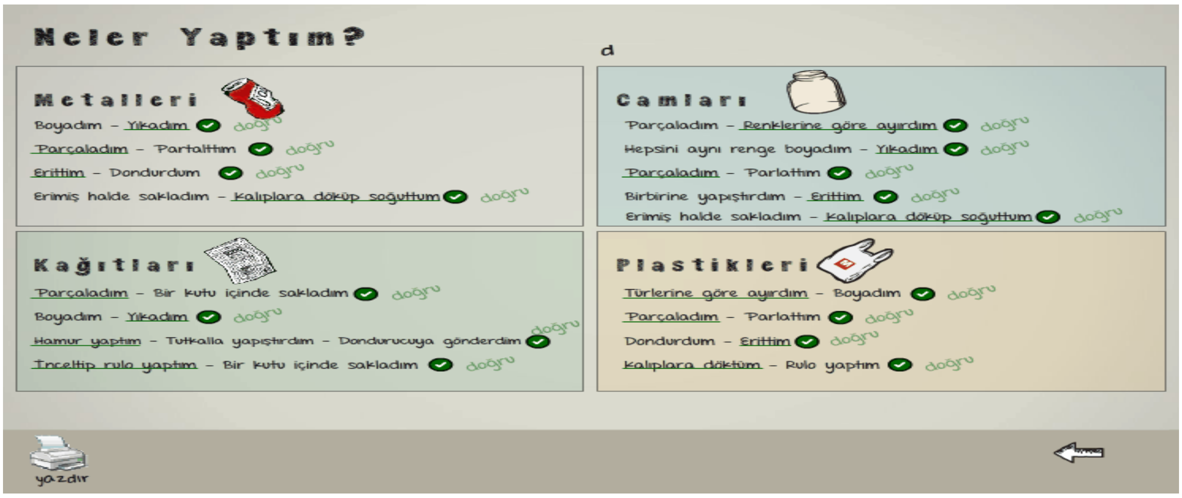

Plastik atıkları türlerine göre ayırdın, parçaladın ve erittin. Son bir işlem daha var. Bu işlemin ne olduğunu hatırlıyor musun?


Parçalanan plastik atıklara şimdi hangi işlem uygulanacak?
(Doğru cevaba tıkla.)
Kalıplara dökeceğim.
Rulo yapacağım.


Bu makinalarda eritilen plastik atıklar işte burada kalıplara dökülüyor!


Fabrikamıza gelen plastiklerle bu geridönüşümün sonunda sence bunlardan hangisini elde edebiliriz?
Defter
Kola kutusu
Süt kutusu


Tüm atıkların geri dönüşüm sürecini bildiğine göre artık işe başlamaya hazırsın. Aferin sana Ahmet.
Çok teşekkür ederim. Senin yardımın olmadan bu işi halledemezdim.


Neler Yaptım?
d
Metalleri
Boyadım – Yıkadım doğru
Parçaladım – Partalttım doğru
Erittim – Dondurdum doğru
Erimiş halde sakladım – Kalıplara döküp soğuttum doğru
Camları
Parçaladım – Renklerine göre ayırdım doğru
Hepsini aynı renge boyadım – Yıkadım doğru
Parçaladım – Parlattım doğru
Birbirine yapıştırdım – Erittim doğru
Erimiş halde sakladım – Kalıplara döküp soğuttum doğru
Kağıtları
Parçaladım – Bir kutu içinde sakladım doğru
Boyadım – Yıkadım doğru
Hamur yaptım – Tutkalla yapıştırdım – Dondurucuya gönderdim doğru
İnceltip rulo yaptım – Bir kutu içinde sakladım doğru
Plastikleri
Türlerine göre ayırdım – Boyadım doğru
Parçaladım – Parlattım doğru
Dondurdum – Erittim doğru
Kalıplara döktüm – Rulo yaptım doğru
yazdır

APPENDIX D: THE RECYCLING COMPREHENSION TEST

1- Büyüdüğümüz için bize küçük gelen giyeceklerimizi ne yapmak doğru olur?

a) Geri dönüşüm kutusuna atmak
b) İhtiyacı olanlara vermek
c) Buzdolabında saklamak
d) Çöpe atmak

2- Geri dönüşüm kutularının renkleri neden birbirinden farklıdır?

a) İçlerine farklı tür atıklar atıldığı için
b) Çevreye renk vermeleri için
c) Hava karanlık olduğunda görünmeleri için
d) Farklı belediyelere ait oldukları için

3- Hangi atıklara geri dönüşüm işlemlerinde eritme ve soğutma <u>YAPILMAZ</u>?

a) Camlar b) Kağıtlar c) Metaller d) Plastikler

4- Bir mahalleden toplam <u>300 kg atık</u> çıkıyorsa, bunun içinde ne kadar <u>geri kazanılabilir atık</u> vardır?

a) 10 kg b) 30 kg c) 100 kg d) 200 kg

5- Ülkemizde 1 kişi 1 günde ortalama kaç kilogram atık üretir?

a) 1 kg b) 10 kg
c) 100 kg d) 1000 kg

6- Doğaya bırakıldığında hangi atıklar diğer atıklara göre daha uzun süre çözünmeden kalır?

a) Kağıtlar b) Camlar c) Plastikler d) Metaller

7- Aşağıdakilerden hangisi geri dönüşüm kutusuna atılabilir?

a) Toprak
b) İçinde pilleri olan bozuk radyo
c) İçinde yemek olan plastik bir kap
d) Üzerinde zımba olan kullanılmış kağıtlar

8- Aşağıdakilerden hangisi geri dönüşümde bütün atıklara yapılır?

a) Eritmek ve Soğutmak
b) Temizlemek ve Parçalamak
c) Hamur yapmak ve İnceltmek
d) Renklerine ayırmak ve Kimyasal eklemek

9- Aşağıdakilerden hangisi atık oluşmasını azaltan bir yol DEĞİLDİR?

a) Ambalajı az olan ürünleri seçmek
b) Uzun ömürlü ürünleri seçmek
c) Ucuz ürünleri seçmek
d) İhtiyacımız olan ürünleri seçmek

10- Bir karton kutu doğaya bırakılırsa ne kadar zamanda kendi kendine çözünerek (parçalanarak) yok olur?

a) 4 ay b) 4 yıl c) 400 yıl d) 40000 yıl

11- Bir plastik şişe doğaya bırakılırsa ne kadar zamanda kendi kendine çözünerek (parçalanarak) yok olur?

a) 4 ay b) 4 yıl
c) 400 yıl d) 40000 yıl

12- "*<u>Kompostlamak</u>*" kelimesi "*<u>toprak için gübre yapmak</u>*" anlamındadır.
Bu işlemde <u>özel olarak</u> aşağıdakilerden hangisi vardır?

a) Yüksek sıcaklık b) Bakteriler c) Macun d) Yumuşatıcı

13- Geri dönüştürülen 1 ton (1000 kg) kağıt yaklaşık kaç ağacı kesilmekten kurtarır?

a) 2 b) 17
c) 53 d) 120

14- <u>Çöplere</u> aşağıdakilerden hangi işlemler yapılır?

a) <u>Depolama</u> veya <u>yakma</u> b) <u>Depolama</u> veya <u>kompostlama</u>
c) <u>Geri dönüşüm</u> veya <u>yakma</u> d) <u>Yakma</u> veya <u>kompostlama</u>

15- Hangi atıklar <u>tekrar tekrar</u> geri dönüştürülebilir?

a) Plastik ve cam b) Cam ve metal
c) Metal ve kağıt d) Kağıt ve plastik

16- Geri dönüşüm yoluyla <u>alüminyum</u> bir malzemeden hangisi elde edilebilir?

a) Okul defteri b) Cam kavanoz
c) Plastik süt şişesi d) Metal içecek kutusu

17- Geri dönüşüm sembolünü kim bulmuştur?

a) Bir üniversite öğrencisi b) Bir temizlik görevlisi
c) Bir fotoğrafçı d) Bir öğretmen

18- Hangisini kağıt geri dönüşüm kutusuna atmak <u>YANLIŞ OLUR</u>?

a) Eski gazete b) Parçalanmış defter
c) Yemekte kullanılmış peçete d) Okulda kullanılmış dosya kağıdı

19- Geri dönüşüm işlemlerinde aşağıdakilerden hangisine kendi türünden (kendisine benzeyen) hammadde eklenir?

a) Camlar b) Metaller c) Kağıtlar d) Plastikler

20- Atıklara yapılan hangi işlemler diğer işlemlere göre <u>doğa için daha iyidir</u>?

a) <u>Depolama</u> ve <u>yakma</u> b) <u>Geri dönüşüm</u> ve <u>depolama</u>
c) <u>Depolama</u> ve <u>kompostlama</u> d) <u>Geri dönüşüm</u> ve <u>kompostlama</u>

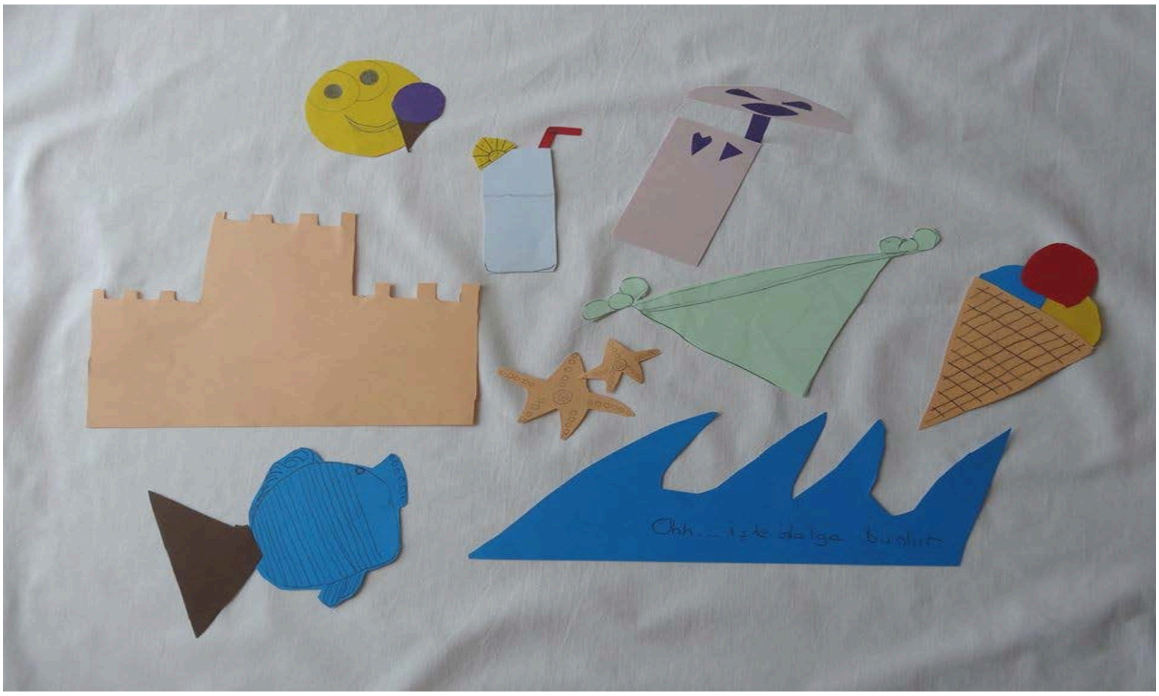
21- Aşağıdakilerden hangisi geri dönüşümün yararlarından <u>DEĞİLDİR</u>?

a) Doğal Kaynaklar korunur b) Enerji tasarrufu olur
c) Çevre teknolojisi gelişir d) Çevre kirliliği azalır

APPENDIX E: SAMPLE FIGURES PREPARED BY THE STUDENTS

Pre-assessment Theme: Fruits

Post-assessment Theme: Summer



APPENDIX F: DATA OBTAINED FROM THE TEST AND ASSESSMENTS

Findings of the Comprehension Tests

Findings of the Comprehension Pre-tests

SECTION A (Traditional)		
Scores	**Frequency**	**Percent**
2	3	9.09
5	6	18.18
6	3	9.09
7	7	21.21
8	4	12.12
9	4	12.12
10	3	9.09
11	1	3.03
12	2	6.06
Total	33	100

SECTION B (Computer-based)		
Scores	**Frequency**	**Percent**
4	3	9.68
5	1	3.23
6	5	16.13
7	1	3.23
8	6	19.35
9	3	9.68
10	6	19.35
11	3	9.68
12	3	9.68
Total	31	100

SECTION C (Traditional)		
Scores	**Frequency**	**Percent**
4	3	9.09
5	2	6.06
6	4	12.12
7	6	18.18
8	7	21.21
9	6	18.18
10	1	3.03
11	1	3.03
12	2	6.06
16	1	3.03
Total	33	100

SECTION D (Computer-based)		
Scores	**Frequency**	**Percent**
3	2	6.06
5	4	12.12
6	2	6.06
7	3	9.09
8	11	33.33
9	6	18.18
10	1	3.03
11	3	9.09
12	1	3.03
Total	33	100

Findings of the Comprehension Post-tests

SECTION A (Traditional)		
Scores	**Frequency**	**Percent**
9	2	7.69
10	2	7.69
11	3	11.54
12	4	15.38
13	4	15.38
14	4	15.38
15	2	7.69
16	2	7.69
17	2	7.69
20	1	3.85
Total	26	100

SECTION B (Computer-based)		
Scores	**Frequency**	**Percent**
7	1	3.85
8	2	7.69
9	2	7.69
10	2	7.69
11	4	15.38
12	4	15.38
13	3	11.54
14	2	7.69
15	2	7.69
16	2	7.69
17	1	3.85
18	1	3.85
Total	26	100

SECTION C (Traditional)		
Scores	**Frequency**	**Percent**
7	1	3.85
8	1	3.85
11	1	3.85
12	5	19.23
14	4	15.38
15	4	15.38
16	4	15.38
17	3	11.54
18	1	3.85
19	1	3.85
20	1	3.85
Total	26	100

SECTION D (Computer-based)		
Scores	**Frequency**	**Percent**
7	1	4.35
9	2	8.70
11	3	13.04
12	2	8.70
14	3	13.04
15	1	4.35
16	2	8.70
17	4	17.39
18	3	13.04
19	1	4.35
20	1	4.35
Total	23	100

Findings of the Attitude Assessments

Findings of the Attitude Pre-assessments

	Section A (Traditional)	Section B (Computer-based)	Section C (Traditional)	Section D (Computer-based)
Papers released to recycling bin, g	364	316	212	326
Papers released to garbage bin, g	36	74	82	86
Rate of papers in recycling bin to total, %	91.00	81.02	72.11	79.13

Findings of the Attitude Post-assessments

	Section A (Traditional)	Section B (Computer-based)	Section C (Traditional)	Section D (Computer-based)
Papers released to recycling bin, g	220	228	192	200
Papers released to garbage bin, g	0	28	38	30
Rate of papers in recycling bin to total, %	100	89.06	83.48	86.96

APPENDIX G: LETTER OF PERMISSION FROM THE MINISTRY OF EDUCATION

T.C.
İSTANBUL VALİLİĞİ
İl Millî Eğitim Müdürlüğü

Sayı : 59090411/44/1257119 — 26/03/2014

Konu: Araştırma (Deniz CANCA)

BOĞAZİÇİ ÜNİVERSİTESİ
(Çevre Bilimleri Enstitüsü)

İlgi: a)14.03.2014 tarih ve 109 sayılı yazınız.
b)Valilik Makamının 25.03.2014 tarih ve 1238030 sayılı oluru.

Üniversiteniz Çevre Bilimleri Enstitüsü Doktora Öğrencisi Deniz CANCA'nın ***"Geri Dönüşüm Konusunda Sınıf ve Bilgisayar Tabanlı Öğretimin Karşılaştırılması"*** konulu tezine dair araştırma çalışması hakkında ilgi (a) yazınız ilgi (b) valilik onayı ile uygun görülmüştür.

Bilgilerinizi ve ilgi (b) Valilik Onayı doğrultusunda gerekli duyurunun araştırmacı tarafından yapılmasını, işlem bittikten sonra 2 (iki) hafta içinde sonuçtan Müdürlüğümüz Strateji Geliştirme Bölümüne rapor halinde bilgi verilmesini arz ederim.

Kahraman DEMİREL
Müdür a.
Şube Müdürü

EK:1- Valilik Onayı
2- Ölçekler

Bu belge, 5070 sayılı Elektronik İmza Kanununun 5 inci maddesi gereğince güvenli elektronik imza ile imzalanmıştır
Evrak teyidi http://evraksorgu.meb.gov.tr adresinden 122c-c509-322f-8a87-0c94 kodu ile yapılabilir.

İl Milli Eğitim Müdürlüğü D/Blok Bab-ı Ali Cad. No:13 Cağaloğlu
E-Posta: sgb34@meb.gov.tr

A. BALTA VHKİ
Tel: (0 212) 455 04 00-239
Faks: (0 212)455 06 52

T.C.
İSTANBUL VALİLİĞİ
İl Milli Eğitim Müdürlüğü

Sayı : 59090411/20/1238030 25/03/2014
Konu: Araştırma (Deniz CANCA)

VALİLİK MAKAMINA

İlgi:a)Boğaziçi Üniversitesinin 14.03.2014 tarih ve 109 sayılı yazısı.
b)MEB. Yen. ve Eğt. Tek. Gn Md. 07.03.2013 tarih ve 316 sayılı 2012/13 nolu genelgesi.
c)Milli Eğitim Araştırma ve Anket Komisyonunun 21.03.2014 tarihli tutanağı.

Boğaziçi Üniversitesi Çevre Bilimleri Enstitüsü Doktora Öğrencisi Deniz CANCA'nın ***"Geri Dönüşüm Konusunda Sınıf ve Bilgisayar Tabanlı Öğretimin Karşılaştırılması"*** konulu tezine dair araştırma çalışmasını Beşiktaş İlçesi Şair Nedim İlkokulunda; ölçek ve anket uygulama istemi hakkındaki ilgi (a) yazı ve ekleri Müdürlüğümüzce incelenmiştir.

Araştırmacının; söz konusu talebi; bilimsel amaç dışında kullanılmaması, veri toplama araçlarının eğitim -öğretimi aksatmayacak şekilde katılımcıların gönüllülük esasına göre seçilmesi, araştırma sonuç raporunun müdürlüğümüzden izin alınmadan kamuoyuyla paylaşılmaması koşuluyla, okul idarelerinin denetim, gözetim ve sorumluluğunda ilgi (b) Bakanlık emri esasları dâhilinde uygulanması, sonuçtan Müdürlüğümüze rapor halinde (CD formatında) bilgi verilmesi kaydıyla Müdürlüğümüzce uygun görülmektedir.

Makamlarınızca da uygun görülmesi halinde olurlarınıza arz ederim.

Dr.Muammer YILDIZ
Milli Eğitim Müdürü

OLUR
25/03/2014

Yusuf Ziya KARACAEV
Vali a.
Vali Yardımcısı

Bu belge, 5070 sayılı Elektronik İmza Kanununun 5 inci maddesi gereğince güvenli elektronik imza ile imzalanmıştır
Evrak teyidi http://evraksorgu.meb.gov.tr adresinden 85fb-4806-30ba-94ff-58c4 kodu ile yapılabilir.

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