A SCIENCE MODULE DESIGNED BASED ON THE ASSURE MODEL: POTENTIAL ENERGY[1]

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ABSTRACT

The purpose of this study is to introduce a science module that was designed based on the ASSURE model and to present its implementation process. The study was conducted with the participation of 21 students attending a private school during the 2020-2021 academic year. The instructional plan focused on the concept of "Relationship between Force, Work, and Energy" in the 7th-grade science curriculum. The module was used in the online live lessons during distance education. The science activities, which were designed by following the phases of the ASSURE model, were implemented in 4 lessons. The students' reflections on the module were received at the end of the study and were analyzed. The data analysis showed that the designed module might effectively support the learning process of the concepts of potential energy, gravitational potential energy, and the effects of mass and height on gravitational potential energy.

Keywords: ASSURE model, science education, potential energy.

ASSURE MODELİNE DAYALI BİR FEN MODÜLÜ ÖNERİSİ: POTANSİYEL ENERJİ

ÖZ

Bu çalışmanın amacı ASSURE modeline uygun olarak tasarlanan bir fen bilimleri modülünün tanıtılması ve uygulama basamaklarının ayrıntılı olarak sunulmasıdır. Çalışma, 2020-2021 eğitim-öğretim yılında bir özel okulda öğrenim gören 21 öğrencinin katılımıyla gerçekleştirilmiştir. ASSURE modeline dayalı olarak hazırlanan modül, 7. sınıf fen bilimleri dersi öğretim programında bulunan "Kuvvet, İş ve Enerji İlişkisi" konusu ile ilgilidir. Çalışma, uzaktan eğitim sürecinde çevrim içi olarak gerçekleştirilmiştir. ASSURE modelinin uygulama basamakları takip edilerek tasarlanan fen bilimleri etkinlikleri 4 ders saati boyunca uygulanmış ve bu uygulamalara yönelik olarak alınan öğrenci görüşleri değerlendirilmiştir. Uygulamadan elde edilen verilerin analizine dayanarak, geliştirilen modülün özellikle potansiyel enerji, çekim potansiyel enerjisi ve çekim potansiyel enerjisinin kütle ve yüksekliğe bağlı olması gibi kavramların öğrenilmesinde etkili olabileceği düşünülmektedir.

Anahtar kelimeler: ASSURE modeli, fen bilimleri öğretimi, potansiyel enerji.

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INTRODUCTION

The rapid advancements in technology have facilitated the design of new instructional models and materials that will boost student participation in learning processes and improve the quality of learning activities (Kim et al., 2013). Students adapt easier to technology-supported learning environments than traditional classrooms, and they expect to engage in technology-enriched learning activities (Kim & Downey, 2016). In order to meet the students' expectations, teachers try to improve the design and delivery of their lesson plans by using the resources available in their existing curriculum. However, they have limited time and resources/support to enhance their instructional materials or approaches (Laurillard et al., 2013). To compensate, some teachers use systematic instructional design models. In particular, the preference of the ASSURE model stands out (Heinich et al., 1999).

The ASSURE model, developed by Heinich, Molenda, and Russel in 1993, is an instructional design guide that integrates technology and multimedia to enhance the learning environment from a constructivist perspective (Lefebvre, 2006). It is an instructional design system and guide that will allow teachers to effectively integrate technology, media, and materials into their lesson plans (Heinich et al., 1999). The ASSURE model consists of the following six phases.

1. Analyze Learners: This is the phase in which the teacher analyzes the characteristics of the students. The data collected on students' general characteristics such as age, academic competencies, gender, interests, prior knowledge, and learning styles will assist the teacher in making decisions and selecting strategies and resources in the other phases of the model.
2. State Objectives: The second phase involves stating the learning objectives, target behaviors, the conditions for acceptable performance, and the degree of mastery. In this phase, the learning objectives are specified in behavioral terms.
3. Select Methods, Media, and Materials: In this phase, the teacher determines the appropriate teaching method(s), plans the learning environment, and selects or designs the materials that will be used in the instruction.
4. Utilize Media and Materials: The fourth phase includes planning about how the selected materials will be used by the students. The materials, the environment, and the students are prepared for the instruction.
5. Require Learner Participation: In this phase, the students actively use the materials and complete the tasks. The active participation of students comes to the fore in this phase.
6. Evaluate and Revise: In this last phase, the entire instructional process is evaluated by answering questions such as "Did the students meet the learning objectives? Were the media/materials used according to their intended purpose?" The instructional processes are revised in light of the evaluation results.

Research studies in the related literature emphasized that as a systematic instructional design process, the ASSURE model is highly preferred and used in science instruction (Elmalı, 2020; Özdilek, 2018). For effective science education, teachers are recommended to consider the individual differences of students (Ministry of National Education [MoNE], 2018), to follow technological developments and integrate them into science lessons, and to plan science activities using various educational technologies (General Directorate of Innovation and Educational Technologies, 2015). In this context, ASSURE is a promising model that might contribute to the implementation of these recommendations for science education due to its features such as analyzing learners, taking the individual differences into account, and planning the effective integration of educational technologies into lessons in a step-by-step process (Chikasanda et al., 2013). In addition, research studies reported that when the ASSURE model is effectively used to integrate technology into instructional processes, students' interest, success, and motivation are positively influenced (Heald, 2016; Kazancı-Gül et al., 2020; Kim & Downey, 2016).

Although the ASSURE model first appeared as an instructional design model to be used in classroom learning environments, it can also be preferred in online education as it guides effective integration of technology into the teaching activities (Abdelaziz, 2013; Çetinkaya, 2017). The development of Web 2.0 tools, virtual communication platforms, and mobile technologies has allowed online learning environments to become widespread in school education (Şimşek, 2016). From this point of view, the ASSURE model, as an alternative instructional design model, can contribute to planning effective online teaching activities and support students' conceptual learning (Elmalı, 2020). This is an important contribution to education in a time where the world is struggling with the COVID-19 epidemic. In this context, the current study might make a significant contribution to the related literature by examining the use of ASSURE model in online education. In the current study, a science module on the concept of potential energy within the "Force and Energy" unit was designed by following the phases of the ASSURE model and was used with the seventh-grade students in an online learning environment.

The concept of potential energy was selected as the science topic of the study because prior studies reported that some students had misconceptions about this topic (Gülçiçek & Yağbasan, 2004; Töman & Çimer, 2011). For example, some students claimed that the potential energy was inversely proportional to the height, or that the kinetic energy would decrease as the potential energy decreases (Gülçiçek & Yağbasan, 2004). In order to minimize possible misconceptions and support robust understanding, the activities of the current study were planned according to the ASSURE model since this model provides opportunities to revise and enhance the instruction in its different phases. Specifically, in the first phase, the instructional plan can be modified based on the students' prior knowledge and needs while in the last phase, the whole instructional process can be evaluated to find out whether conceptual learning has taken place or not.

ACTIVITY IMPLEMENTATION

The current study took place in a private middle school with the participation of 21 seventh-grade students, after obtaining the ethics committee approval (Karamanoglu Mehmetbey University Scientific Research and Publication Ethics Committee, document numbered E-95728670-020-10067) and parent-student consent forms for using the photographs taken during the lessons. The science module was taught in live online lessons and took 4 lesson hours.

The module focused on gravitational potential energy and emphasized that gravitational potential energy depends on mass and height. This module is part of a unit that involves the relationship between energy, work, and force and explains related concepts such as potential and kinetic energy. The implementation of the module is described below according to the phases of the ASSURE model.

1. Analyze Learners

In this phase, data were collected about the participating students' age, gender, family socio-economic status, prior knowledge, learning styles, and access to and use of internet. In order to obtain the data, interviews were conducted with the school administrators, classroom teacher, and parents within the scope of the legal permissions. The mean age of 21 seventh-grade students (16 girls, 5 boys) participating in the study was 13. The study was carried out with students attending a private school and their socio-economic levels (parent's education level, occupation, and income) were classified as medium/high by the researchers in light of the information obtained from the parents. To determine the students' prior knowledge, their science grades from the academic year prior to the fall semester of 2020, in which the study was conducted, were examined, showing that there were no unsuccessful students and all students received a passing grade (45 or above out of 100). In addition, students' conceptions about the basic concepts such as mass, weight, gravitational force, and work were formatively assessed using the question-answer method at the beginning of the first lesson of the 4-hour science module. The teacher observed that most students did not have any difficulties in defining these basic concepts and that they had the necessary background knowledge to participate in the module activities. The classroom teacher and the science teacher shared information about the students' learning styles. According to these teachers, the participating students generally preferred to learn abstract concepts using concrete objects or visual materials. At the time of the study, two participants were receiving education from the music/art and general ability departments of the Science and Art Center (BILSEM).

Since the science module was to be taught online and required the integration of educational technologies based on the ASSURE model, it was important to collect data on students' computer use and internet access. The collected data revealed that only one student used a tablet and the other students used computers to attend online lessons. None of the students had any issues with internet connectivity. Moreover, the data obtained from the school administration showed that all students successfully completed the information technology course which all students had to take as part of the regular middle school curriculum. Related to this finding, the science teacher observed that the students had actively used computers/tablets and participated in online lessons without having any problems prior to the current study. In light of all the findings about the learners, the researchers decided that it was appropriate to integrate Web 2.0 tools such as interactive simulations and Kahoott program into the module lessons, to teach the concepts of gravitational potential energy and how this energy would change depending on mass and height based on the students' prior knowledge, and to design learning tasks that would allow students to learn by experiencing. Accordingly, the researchers continued the design process of the science module by following the other phases of the ASSURE model step-by-step.

2. State Objectives

This phase presents the learning objectives of the designed module. The science curriculum includes the following two benchmarks under the "Relationship between Force, Work, and Energy" curriculum standard within the "Force and Energy" unit: 1) Potential energy is classified as gravitational potential energy and elastic potential energy. 2) Potential energy is described to be dependent on mass and height (MoNE, 2018). The current study aimed to teach students the science knowledge related to these benchmarks. Specifically, the module aimed for students to define potential energy and gravitational potential energy, to classify potential energy as gravitational potential energy and elastic potential energy, to explain gravitational potential energy by giving examples from real life, and to conjecture that gravitational potential energy depends on mass and height. At the knowledge and comprehension levels, students are expected to define the concepts of potential energy and gravitational potential energy and give examples from real life. Regarding higher-order thinking levels, several activities of the module require students to observe the change in gravitational potential energy at different heights and masses and reach a conclusion based on their observations. For example, in the designing a car activity, the students will use the car model they designed to explain how different heights affect gravitational potential energy. Additionally, they will examine the change in gravitational potential energy by placing a variety of masses on their car. Methods, media, and materials selected in line with these objectives are explained in the third phase below.

3. Select Methods, Media and Materials

This phase involves planning the teaching process based on the information obtained in the "Analyze Learners" phase. The first phase of the ASSURE model determined that the students knew the basic concepts such as mass, weight, gravity, and work. They also did not have any problems in using computers and accessing the internet. In this context, the researchers decided to use Web 2.0 tools and educational software such as Kahoot, interactive simulations, Prezi, and the inspiration program to help the students learn the concepts of potential energy and gravitational potential energy and examine the variables affecting gravitational potential energy. In addition, a teaching activity that can be implemented in the online lessons was planned to provide the students a hands-on learning experience. This activity requires the use of simple materials that can be easily obtained. It was planned that each student would complete the activity individually in the online learning environment and observe how the variables of mass and height influence gravitational potential energy. The hands-on activity entitled "Using Fruits and Vegetables to Explore Gravitational Potential Energy" requires the following economic and affordable materials: various fruits and vegetables, two skewers or four toothpicks, fruit knives, liquid glue or hot glue gun, a platform that can be used as a ramp or 8-10 textbooks, and other optional materials for decoration.

4. Utilize Media and Materials

This phase includes deciding whether the learning environment is suitable for using the tools and materials and what additional equipment (internet connection, camera, headset, charger, etc.) is necessary. In the current study, a smartphone application was used to ask the students to be ready for the lesson by opening the related Web 2.0 tool/educational software (these tools were selected in the third phase of the ASSURE model) on their computer or tablet. Similarly, the students were asked to prepare all the required materials for the "Using Fruits and Vegetables to Explore Gravitational Potential Energy" activity before the online lesson. At the beginning of each lesson, the students informed the teacher that they completed their preparations and were ready for the lesson.

5. Require Learner Participation

This phase engages the students in active learning by completing a variety of tasks. In the current study, the science teacher introduced the topic of the module by asking the students some real life related questions. He asked, "What do vehicles such as cars, airplanes, and trains need to move?" and "How do we meet our basic needs such as heating or home lighting?" to get the students thinking about the topic of the module.

To answer the first question, the students gave responses such as "They need force." "Diesel is required." "They need energy." and "Need a battery." The responses to the second question included "The Sun illuminates." "We meet our need for home lighting using bulbs." "We use natural gas for heating." and "We light a fire to keep warm." After receiving the students' answers, the teacher summarized their responses and concluded the discussion by saying that energy is needed for these vehicles to move and that we use different energy sources such as electricity and natural gas in our daily lives for heating and lighting. Afterward, he explained that electrical energy is one of the most commonly used forms of energy and can be produced by hydroelectric power plants. He told the students that they will use an interactive simulation titled "Hydroelectric Power Plant" (This simulation was selected in the third phase of the ASSURE model). Each student accessed the digital content that shows the production of electrical energy in hydroelectric power plants (Figure 1) by visiting the relevant website where interactive resources for science education are available (EduMedia, n.d.). By following the flow in this simulation, the students examined how to generate electricity from the water accumulated in the dams and shared their observations with each other.

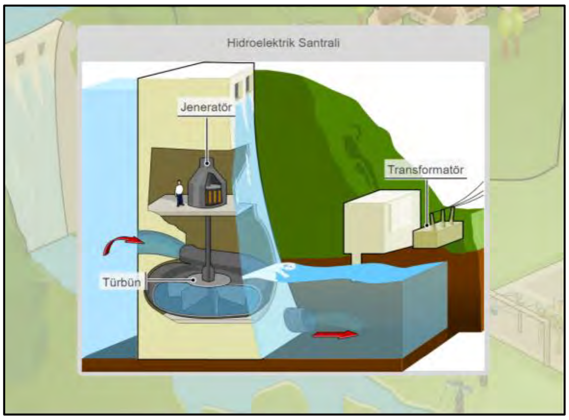


Figure 1. Hydroelectric Power Plant Simulation

The students observed that the force of falling water causes the turbine wheels to rotate. They shared the processes they noticed in the simulation after watching it several times. For example, one observation shared was that the generator works as a result of the rotation of the turbine wheels. In addition, the students discussed that hydroelectric energy less damages the environment during the electricity production compared to some other energy sources and it does not create environmental and air pollution. This simulation emphasizes that the gravitational potential energy of the water stored in the dam is first converted to kinetic energy as the water falls down from the dam, then to electrical energy by operating the turbine wheels and thus spinning the generator that the wheels are connected to. After the activity that included "Hydroelectric Power Plant" simulation was completed, the teacher elaborated on the concepts of potential energy and gravitational potential energy using the Prezi program.

The next activity was the hands-on learning activity, Using Fruits and Vegetables to Explore

Gravitational Potential Energy, which was planned in the third phase of the ASSURE model. The necessary materials for the activity were prepared in the fourth phase. As part of this activity, the students designed a car model using the fruits and vegetables that they chose (e.g., carrot, radish, cucumber, eggplant) (Photograph 1).

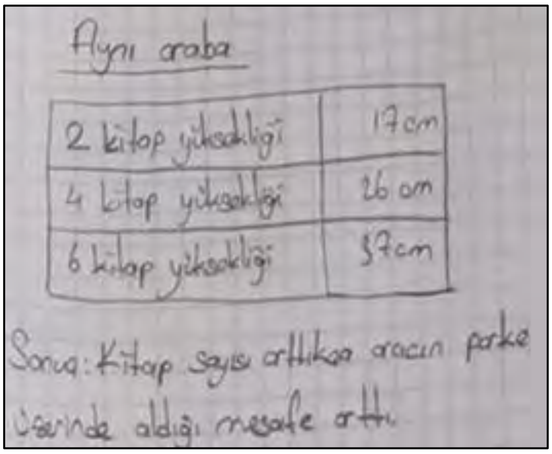

Photograph 1. A Car Made of Carrot and Cucumber

Each student introduced his/her car model to the other students during the lesson. Some students continued to work on their designs outside of class hours. However, they all completed their car models by the third lesson of the module. During the third lesson, the students were asked to create ramps with different heights. Using materials such as wood, books, or cardboard, the students created ramps that could be adjusted to have different heights. They rolled their cars down the ramps, measured the horizontal distance the car traveled, and noted the data in their science notebooks (Photographs 2-3).

Photograph 2. One Student's Ramp and Its Height


Photograph 3. A Car was Rolled Down From Different Heights

Next, the students were told to add different masses to their cars and roll them down from the same height (the same ramp). They measured the distance traveled. This activity allowed the students to develop conjectures about the horizontal distance traveled by the cars having the same mass but rolled down from different heights or having different masses but rolled down from the same height. By examining the measurements, that they wrote down in their science notebooks, the students deduced that the car they rolled down from the higher ramp traveled a longer distance (Photograph 4). They also concluded that as the mass of the car left from the same ramp increases, the distance traveled on the horizontal direction also increases. The teacher connected the students' observations to the concept of potential energy by explaining that gravitational potential energy changes depending on height and mass and the distance traveled in the horizontal direction is related to this concept.



Photograph 4. A Student's Notes in Her Science Notebook

The last activity in this final phase of the ASSURE model involved using the "Energy Skate Park" simulation developed by the University of Colorado (Physics Education Technology Project, n.d.) to experiment with mass and height to examine their influence on the gravitational potential energy. Using their tablets or computers, the students interacted with the simulation and observed the paths taken at different heights and masses by the skater.

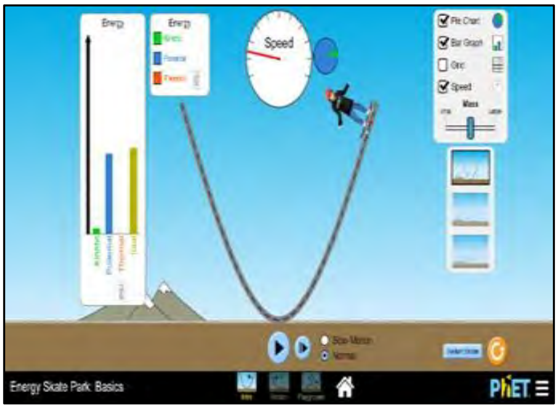


Figure 2. Energy Skate Park Simulation

They also compared the observations made in this interactive simulation to the conclusions drawn from the experiment with the designed cars. In their comparison, the students explained that different heights and masses affect the distance traveled due to changes in gravitational potential energy in both activities. For example, one student said the following:

> According to my observations, I noticed that gravitational potential energy changes based on height and mass. So, when I increased the number of books, the height increased and [the car] went further. Also, as the number of coins increased, the mass increased, and my car went further because its energy increased.

The fifth phase of the ASSURE model was completed as described above. The final phase, the evaluate and revise, is described in the following section.

6. Evaluate and Revise

The last phase of the ASSURE model involves reviewing the whole instructional planning and implementation. The virtual materials and innovative technologies used and the activities implemented are evaluated (Elmalı, 2020). It is examined whether the students reached the learning objectives (ASSURE model-second phase) and whether the selected materials (ASSURE model-third phase) were used in alignment with their purpose. In this context, a decision tree created with the "Inspiration" program, a puzzle created with the "Crossword Labs" program, and the Kahoot program were used in the fourth and final lesson of the science module in order to evaluate the learning outcomes on potential energy, gravitational potential energy, and the change of gravitational potential energy depending on mass and height. Additionally, a form consisting of open-ended questions was used to determine the students' views on the science module.

Figure 3 shows the decision tree used in the current study. The teacher created the decision tree using the Inspiration program (Appendix 1) and presented it to the students in the last online lesson.

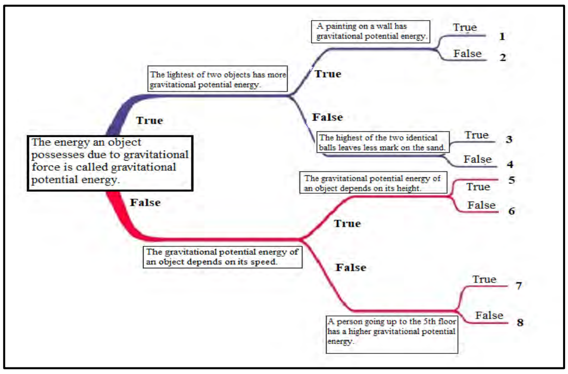


Figure 3. The Decision Tree Created with the Inspiration Program

Each student decided on the statements (decision nodes) in the decision tree as true or false and moved on to the next statement according to their decision. Proceeding in this way, they informed their teachers through the SebitVcloud program which end node they reached. Afterward, they evaluated the statements again with the teacher and clarified that the correct end node to reach is the fourth exit. The teacher provided scientific explanations for each statement. Related to the statement "The highest of the two identical balls leaves less mark on the sand." some students said that they gave an incorrect decision about it since they did not know the meaning of the word "identical." Thereupon, the teacher defined the concept of being identical and explained the statement from a scientific point of view. Some students could not decide whether the energy should be interpreted according to mass or height in the statement "The lightest of two objects at the same height has more gravitational potential energy." and chose the incorrect exit node. In total, 15 students reached the correct end node (exit 4) while six students reached incorrect end nodes (exits 1, 2, or 3).

The second evaluation tool consisted of 12 questions prepared by the teacher using Kahoot, a web 2.0 tool (Figure 4). The questions were about the concepts of potential energy, gravitational potential energy, and the variables affecting gravitational potential energy. The students accessed the questions by entering the relevant web address (https://kahoot.it/) on their computers and tablets and answered the questions individually during the online lesson. The Kahoot application provided the teacher with a report on the time used to answer the questions and the students' performance. The teacher checked the answers after all students finished answering the questions. Sixteen students answered all questions correctly, three students answered two questions incorrectly, one student answered three questions incorrectly, and one student answered five questions incorrectly. The class discussed the questions answered incorrectly. This assessment revealed that most students comprehended the effects of mass and height on gravitational potential energy.

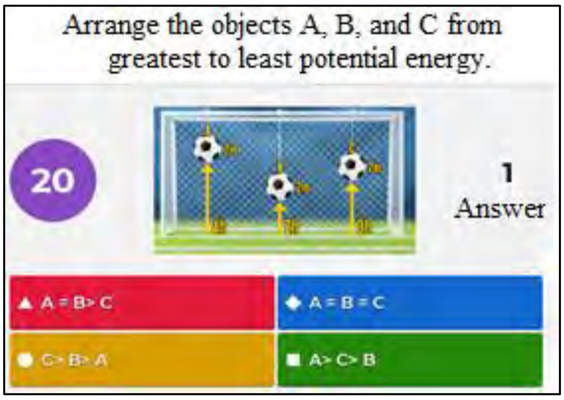


Figure 4. A Sample Question Created on Kahoot

The third assessment tool engaged the students in creating a puzzle using the Crossword Labs program. The whole class worked collaboratively to make a puzzle about the concepts of potential energy and gravitational potential energy. The puzzle-making process was highly enjoyable for the students and allowed the teacher to assess their learning as they spoke about the content covered in the module. The students provided the answers to the questions they suggested for the puzzle. Overall, these three evaluation tools revealed that the students reached the learning objectives about how the height and mass variables affect the gravitational potential energy. Therefore, the researchers decided not to make any revisions to the developed module in terms of the conceptual organization.

In the final phase of the ASSURE model, receiving feedback from the students is important to reconstruct the instructional plan, integrate student ideas into future lesson plans, and make revisions if necessary (Kim & Downey, 2016). Accordingly, the final assessment tool used in the study is an interview form consisting of open-ended questions designed to find out the students' views on the science module planned based on the ASSURE model (Appendix 2). This form consists of six questions focusing on the students' reflections on their experiences, learning, and performance within the module lessons. Specifically, the open-ended questions asked the students to reflect on the relationship between the activities and the learning objectives, the connection between the module content and real life, the adequacy of the time allocated for the tasks, the supply and usefulness of the materials used, and the possible benefits of using similar activities in future science lessons during distance education. The students who participated in the study received the form in the fourth lesson and sent it back to the teacher when they completed it.

In the interview form, the students wrote positive comments about the overall design of the science module and its implementation during distance education. They expressed the view that the activities were fun to do and made the content comprehensible. In addition, they explained that after designing their cars using the specified materials, examining the horizontal distance traveled by the cars having the same mass but rolled down from different heights or having different masses but rolled down from the same height helped them realize how the gravitational potential energy changes depending on mass and height. The students noted that according to their observations, the distance traveled on the horizontal direction increased when they rolled the car down a higher ramp and similarly it increased as the mass of the car left from the same ramp increased. They added that this hands-on activity helped them make connections to real life. For example, one student explained that when he goes down a higher hill while cycling, he can go further without rotating the pedals (same mass, different heights), and now he understands more clearly that this is due to the variables affecting the gravitational potential energy. The students shared a variety of examples to show that the gravitational potential energy can change depending on the mass and height. One such example is as follows: “The glass dropped from a high-floor shatters, while the same glass dropped from a lower height breaks into several pieces.”

Regarding obtaining the materials used in the activities, the students wrote that they did not have any problems in this regard since most materials were available in their homes. According to the students, they had a concrete learning experience on how the gravitational potential energy changes depending on mass and height with the help of using materials. The following quote is an example of this view:

> The activity gave me a hands-on and experiential learning opportunity to understand that the gravitational potential energy of an object can change depending on its mass and height from the ground. For example, the stone I release from a greater height makes a larger mark on the sand. Now, I know that it is about gravitational potential energy. I have a robust understanding of how gravitational potential energy changes depending on mass and height.

The student who expressed her thoughts above also stated that she learned the subject in a shorter time and that she could solve the related questions easily based on her engagement in the module activities without the need to memorize how the height and mass variables affect potential energy.

However, the students emphasized that the vegetables and fruits, which were thought to be obtained easily by the researchers, deteriorated (e.g., blackening) after the activity and suggested making designs with different materials such as cardboard, toy wheels, craft paper, or cardboard. The vegetables and fruits did not seem to be suitable for long-term use. Therefore, the researchers decided to revise the materials in the future implementations of the module.

Finally, the students wrote about their preference for engaging in similar activities while learning other topics. For example, one student wrote the following:

> I think it was a good way to learn. I would love to do similar activities on other content as well.

Students’ views on the module revealed that they liked the module activities and would like to engage in similar activities in the future.

CONCLUSION and SUGESTIONS

This study examined a science module planned and implemented based on the ASSURE model to teach the curriculum standards related to potential energy, gravitational potential energy, and the effects of mass and height on gravitational potential energy. By following the six phases of the ASSURE model, the module involved educational technologies, various interactive applications, and hands-on learning activities. The implementation process took place in an online learning environment.

In previous studies, the ASSURE model was generally used in classroom learning environments (Kim & Downey, 2016; Shelly et al., 2012). This study contributes to the related literature as it illustrates a successful application of the ASSURE model in an online learning environment (Çetinkaya, 2017). This contribution is particularly important as online education has become a necessity due to factors such as the Covid-19 pandemic (Keleş et al., 2016). The findings of this study suggest that different applications of the ASSURE model can be used to plan instructional units/lessons for other science topics.

The ASSURE model emphasizes the effective integration of educational technologies into the learning processes (Shelly et al., 2012). In this study, new generation internet technologies (i.e., Web 2.0 tools) and interactive simulations were used in the lessons. Aligned with the related literature, it was observed that integrating educational technologies into the science lessons promoted conceptual learning, motivation, and participation (Heald, 2016).

Therefore, the researchers suggest ASSURE as an effective instructional design model that can guide the planning and use of appropriate technologies in science education.

As presented in the current study, the ASSURE model shows teachers how to plan a science lesson that will include educational technologies. The ASSURE model, which step-by-step explains the instructional planning, the selection and use of the materials, and the evaluation of the learning outcomes, is a guiding educational model for all teachers who want to benefit from educational technologies to increase student motivation in their lessons (Shelly et al., 2012). The science teacher, who took part in the current study and implemented the instructional plan following the ASSURE model, observed that one student who previously had not participated in the online lessons attended the lessons by turning on his camera. Some students noticed their abilities while completing the activities and designing their cars, and they were very pleased with this situation. The ASSURE model is an alternative instructional design model for teachers who want to use materials and technology effectively and efficiently. Using appropriate materials and technology in instruction requires experience (Elmalı, 2020). However, since it guides the instructional design process step by step and integrates educational technology to enhance the learning environment, the ASSURE model will be beneficial for teachers who have just started their profession, as well as for experienced teachers (Smaldino et al., 2021).

In addition to science instruction, the ASSURE model can be used to design instruction in other fields such as mathematics and at different grade levels for in-class or online education (Keleş et al., 2016). The current study shared teaching activities on potential energy and gravitational potential energy for the seventh-grade students. The authors suggest that these activities are used by other science teachers. In future implementations, teachers may use long-lasting materials such as toy wheels and cardboard instead of vegetables and fruits for the car design activity so that the car may be used for a longer period. Another suggestion is to design science lessons for other science topics. Science teachers at different grade levels can use the ASSURE model to design instruction that focuses on the following concepts: movements of the moon, friction, shadow (fifth grade); respiratory system, digestive system, density (sixth grade); recycling, refraction of light, lenses (seventh grade); pressure, acids and bases, simple machines, matter (eighth grade). Teachers may use the model to plan lessons on any topic they find appropriate and teach those lessons in different learning environments such as in-class or online.

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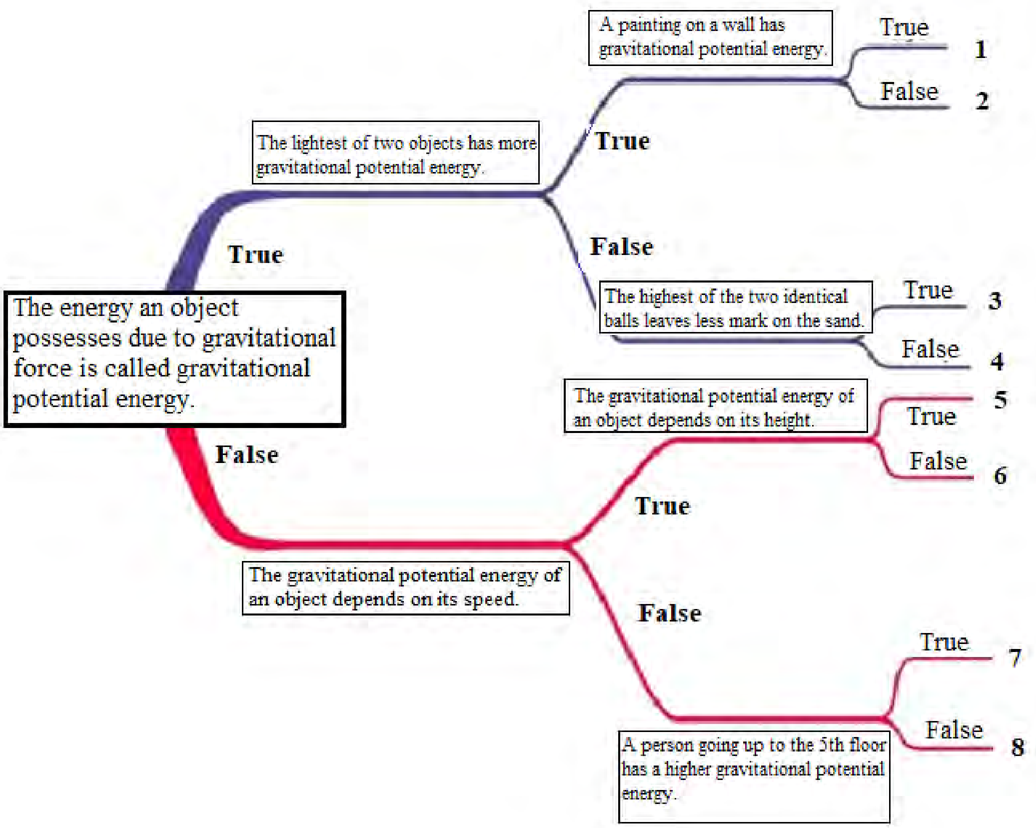
Appendix 1

The Decision Tree Used in the Study



Appendix 2

Student Interview Form

This form consists of open-ended questions to understand your feelings and thoughts about the activities we used in the most recent science module that was designed based on the ASSURE model. Your answers to these questions will not affect your success in the course or your grades. Please answer the questions sincerely.

Thank you.

1. What do you think about how the activities included in the module relate to the learning objectives?
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2. How are the activities related to real life?
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3. What do you think about the adequacy of the time allotted to complete the activities?
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4. Did you have any problems with obtaining or using the materials needed for the activities?
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5. What do you think about using similar activities in future concepts during distance education?
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