Journal name	International e-Journal of Educational Studies
Abbreviation	IEJES
e-ISSN	2602-4241
Founded	2017
Article link	http://doi.org/10.31458/iejes.1351360
Article type	Research Article
Received date	28.08.2023
Accepted date	04.10.2023
Publication date	21.10.2023
Volume	7
Issue	15
pp-pp	817-830
Section Editor	Prof.Dr. Suat ÜNAL
Chief-in-Editor	Prof.Dr. Tamer KUTLUCA
Abstracting & Indexing	Education Source Ultimate Database Coverage List EBSCO Education Full Text Database Coverage List H.W. Wilson Index Copernicus DRJI Harvard Library WorldCat SOBIAD
Article Name	Guidance Materials Enhanced with Digital Content to Understand the Characteristics of Birds and Student Opinions.

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Abstract

The purpose of this research is to develop guide materials on "Features of Birds", to apply the materials and to get students' opinions about the materials. The participants of the study consisted of 28 students studying in the 5th grade of a public secondary school in the 2022-2023 academic year. In the study, the development and application processes of the guide materials used are explain in detail. After the application, an interview form consisting of five questions was applied to 28 students in order to get the opinions of the students about the guide materials. Descriptive analysis was used to analyze the interviews. As a result of the research; It was determined that the guide materials enriched with digital contents increased the students' interest in the subjects, aroused curiosity, they learned by having fun, and they wanted similar applications in other subjects.

To cite this article:

Nizam, M., & Öner-Armağan, F. (2023). Guidance materials enhanced with digital content to understand the characteristics of birds and student opinions. *International e-Journal of Educational Studies, 7* (15), 817-830. https://doi.org/10.31458/iejes.1351360

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Research Article

Guidance Materials Enhanced with Digital Content to Understand the Characteristics of Birds and Student Opinions *

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Abstract

The purpose of this research is to develop guide materials on "Features of Birds", to apply the materials and to get students' opinions about the materials. The participants of the study consisted of 28 students studying in the 5th grade of a public secondary school in the 2022-2023 academic year. In the study, the development and application processes of the guide materials used are explain in detail. After the application, an interview form consisting of five questions was applied to 28 students in order to get the opinions of the students about the guide materials. Descriptive analysis was used to analyze the interviews. As a result of the research; It was determined that the guide materials enriched with digital contents increased the students' interest in the subjects, aroused curiosity, they learned by having fun, and they wanted similar applications in other subjects.

Keywords: Augmented reality, coding, concept cartoon, features of birds

1. INTRODUCTION

In the last century, where information and technology have rapidly developed, it is seen that great changes have occurred in many different fields. In order to keep up with these changes and adapt to the age, the education system needs to be reorganized according to the changing conditions (İşçi & Yazıcı, 2023). The updated new education system aims to enable students to construct their own knowledge. In this direction, constructivism has become one of the prominent philosophies in our education system. According to Dewey (1996), one of the pioneers of the constructivist approach, the teaching process should move away from rote memorization and instead involve active participation of students. The provided information should match the content of life. Students should be active in the field of thinking and practical application. The learning process should be based on individual experience because human consciousness is a product of their individual experiences. Today, it is accepted that learning by doing and experiencing is more effective in terms of permanence.

In this context, by engaging students actively, they use their minds and experiences and enter into the process of learning. The constructivist approach applied in science education enables individuals to learn concepts more meaningfully and permanently by moving away from memorization and building on their past learning (Lee & Fraser, 2000). Constructivism is an educational approach designed to enable students to actively carry out the process of learning and apply the information they

Received Date: 28/08/2023 **Accepted Date:** 04/10/2023 **Publication Date:** 21/10/2023

* ***To cite this article:*** Nizam, M., & Öner-Armağan, F. (2023). Guidance materials enhanced with digital content to understand the characteristics of birds and student opinions. *International e-Journal of Educational Studies, 7* (15), 817-830. https://doi.org/10.31458/iejes.1351360

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have learned, and it is used in science education to provide students with a more effective learning experience. Such theories should be included for meaningful learning to occur and for learning to be permanent (Jonansen, 1999). In this regard, in order for learning to take place, an environment and educational activities that will arouse students' curiosity and increase their desire to learn should be provided. Science lessons enable students to understand the natural world and better grasp scientific concepts. One of the science topics that involve the natural world is the "Let's Get to Know Living Things" unit. When the literature on the classification of animals is examined, it is seen that students have many misconceptions about the classification of animals (Özdemir & Çalışkan, 2018; Yen, Yao & Mintzes, 2007). However, there is no study in the literature that develops guidance materials on this subject. The present study is important in terms of detecting and eliminating misconceptions by developing guidance materials for birds. Thus, the study will fill this gap in the relevant literature. Based on this situation, the use and implementation of relevant guide materials in the subject is important for students to understand and grasp science concepts, and acquire the necessary knowledge and skills. As a result of the advancement of today's technologies, individuals of Generation Z who are closely intertwined with the internet have emerged. Generation Z mostly desires to learn through games and funy methods (Büyükuslu, 2017). Therefore, it is important to take this into account when developing guide materials for science classes. Based on this, a fictionalized example event about the characteristics of birds from vertebrate animals was enriched with different activities such as QR codes, concept cartoons, coding, and augmented reality to bring a different perspective to the topic. Additionally, this guide material was designed to help fifth-grade students recognize birds and develop an interest in science topics. It is thought that it will help students to gain more knowledge about birds and better understand the characteristics of the birds around them. The purpose of this study is to determine the opinions of fifth-grade students on materials enriched with digital content prepared to help them understand the characteristics of birds in the Living World unit of the Science course.

2. METHOD

2.1. Research Model

In the study, case study design from qualitative research methods was used. In the case study, the current situation is examined and defined in depth through observations, interviews, documents and/or reports carried out in a certain period (Merriam & Tisdell, 2015). In this context, single-case holistic research design was used to examine the students' opinions about the activity in the present study. A single-case holistic study aims to present a thorough and in- depth analysis of the case as a whole, without segmenting it into subunits or subcases (Yin, 2009).

2.2. Participants

The activity was conducted with 28 fifth grade students in a public secondary school. The participants of the study were determined by convenience sampling method, one of the purposeful sampling methods. In this sampling, the researcher selects individuals or groups that are easy to access (Fraenkel et al., 2012). While examining the data, student names were coded as S1, S2… and S28 in order to keep students' personal information confidential.

2.3. Data Collection Tool

An interview form consisting of five open-ended questions was directed to 28 students who participated in the application in order to determine the students' views on the activities developed. The open-ended interview questions were adapted from the interview questions prepared by Varinlioğlu, Öner Armağan, and Bektaş, (2022), and Yazıcıoğlu and Çavuş-Güngören (2021). The authors obtained feedback from a Turkish teacher, two science teachers and two science educators about the content and readability of the questions. The interview form was analyzed using descriptive analysis, with the steps being followed and presented in tables (e.g., coding the data and creating categories; Corbin & Strauss, 2007).

2.4. Planning and Implementation Process of the Activity

In this section, the ways followed for the planning and implementation process of the study are presented in stages.

2.4.1. Examining the objectives of the unit:

When the fifth-grade Science curriculum implemented by the Ministry of National Education in 2018 is examined, it can be seen that 12 lesson hours are allocated to the unit "Let's Recognize Living Things". In this unit, it is aimed for students to gain knowledge and skills about classifying living things based on their similarities and differences, microscope, microscopic organisms, fungi, plants, and animals. In this regard, it is desired to gain a single learning outcome as "Classifies living things according to their similarities and differences by giving examples". Hovewer, it is thought that it will be difficult to teach the unit with a single leraning outcomes. Therefore, in this study, it is desired to narrow the subject and design activities for recognizing the characteristics of birds.

2.4.2. Literature review

When the literature on the topic is examined, it is found that students have many misconceptions regarding the classification of living organisms (Özdemir & Çalışkan, 2018; Ural Keleş & Aydın, 2012; Yen et al., 2007). Some of the conceptual misconceptions identified in studies on the classification of living organisms are presented in Table 1.

Table 1. Conceptual misconceptions in the literature regarding the classification of living organisms.

Misconceptions	Studies in which misconceptions were identified
Every living creature that flies is a bird	Özdemir & Çalışkan, 2018
Penguin is in the group of fishes	Çardak, 2009
Penguin is in the class of mammals	Çardak, 2009; Kubiatko & Prokop, 2011; Trowbridge & Mintzes, 1985
Bat is in the class of birds	Chen & Ku, 1998; Çardak, 2009; Kubiatko & Prokop, 2011
Butterfly is in the class of birds	Ural Keleş, Çepni, Aydin & Haşıloğlu, 2011

Taking into account the misconceptions in the field of ecology, it has been decided to prepare activities supported by digital content to help students better understand the characteristics of birds and make the subject more interesting. It is emphasized in many studies that the integration of technology into education improves student learning experiences (Stec, Smith, & Jacox, 2020).

2.4.3. Development of guide material

While designing the activity, the learning outcomes in the science curriculum were taken into account. In the activity, attention was paid to enable students to learn the subject in a meaningful way and have fun throughout the lesson. In order to ensure content validity, two science teachers, two science educators and a Turkish teacher were asked to evaluate the guide materials prepared. According to the feedback received in this process, the readability of the material was ensured and corrections were made in the sentences. The prepared guide material is given in the Appendix.

2.4.4. Obtaining necessary permissions

Necessary permissions have been obtained from the Erciyes University Institute of Educational Sciences for the research titled 'Guide Materials Enriched with Digital Content to Grasp the Characteristics of Birds and Student Opinions' with issue date and number 31/01/2023-49, and throughout the study process, scientific and ethical principles have been followed, and all resources utilized have been cited in the references.

2.4.5. Implementation of the activity

The guide material activities were conducted by the first researcher who is a teacher in the school where the activity was applied. One day before the activity, students were informed about how the application will be carried out, including the use of QR codes, augmented reality application, video watching, and filming related to the subject, and it was demonstrated practically. During the implementation of the application, those who had access to smartphones and tablets were asked to bring their devices and headphones and to install the necessary applications, and the school administration was informed and permission was obtained. The activity lasted for two class hours (40min + 40min). A class hour (40min) was allocated for interview questions prepared to learn students' opinions about the application. The activity was distributed to students in writing, and the activity was opened from the smart board. Firstly, they were asked to read the sample case and then, using the QR codes, they would watch the videos to gain in-depth knowledge about the topic. Then, they were informed about how they would progress in the activity sheets, and the application was started.

The students who did not have the opportunity to use smartphones or tablets carried out the activities without using the applications.

Figure 1. An image of the participation process of the event

During the process and the break between two class hours, it was not allowed for more than one student to go outside at the same time in order to prevent students from interacting with each other. In the last 15 minutes of the second class, the final stage of the activity, which was about taking a video on the characteristics of birds, was carried out with volunteer students. At this stage, students scanned the QR code on the activity paper. https://www.google.com/search?hl=tr&q=Kaya%20Kartal%C4%B1 The event was ended by making a 3D video introducing the features of the eagle by providing a link to the address.

Figure 2. An image of video shooting event

In the third lesson hour, a form consisting of five open-ended questions was distributed to the students and their opinions about the application were taken.

2.5. Data Analysis

In this research, which was carried out to determine the opinions of the participants about the activity, the analysis of the data was carried out with descriptive analysis. Descriptive analysis is defined as describing the data and explaining the descriptions (Merriam & Tisdell, 2015).

3. FINDINGS

Some of the students used tablets/mobile phones in the activities and some students did not. The findings regarding the tablet or mobile phone usage status of the students during the implementation of the activities are given in Figure 3.

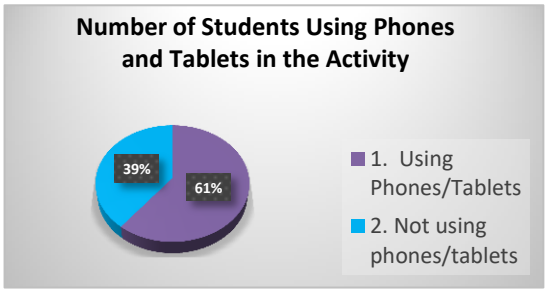

Figure 3. Number of students using phones and tablets in the activity

According to Figure 3, 17 (61%) of the 28 students who participated in the activity used phones or tablets, while 11 (39%) did not use phones or tablets. In the research, the first question posed to students was"Do you think that the activities of "Let's get to know the characteristics of birds are beneficial for you?" The answers given to the question are given in Figure 4.

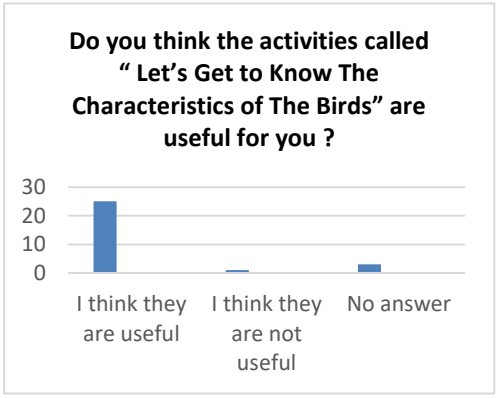

Figure 4. Let's get to know the characteristics of birds do you think the activities are beneficial for you?

According to Figure 4, 25 students who participated in the activity found the activity useful, while three people left the question blank and one did not find it useful. S14 among those who found it helpful *"Yes, I think because I learned more about birds."* S25, who did not find it useful, explained the reason for this situation by saying, *"I don't think it happened. I couldn't get into the application, even though it's good, I don't know."* They have stated as. In the research, the second question posed to students was "Do you think it would be beneficial for you to carry out these activities in other Science course subjects?" The answers to the question are given in Figure 5.

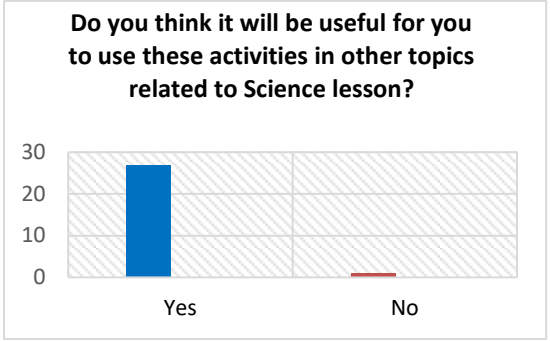

Figure 5. Do you think it would be beneficial for you to carry out these activities on other science subjects as well?

According to Figure 5, 27 of the students who participated in the activity participated in these activities. While stating that it would be beneficial to do it in the subjects of Science course, one person stated that he did not think it would be beneficial. Answering yes, S26 said "*Yes, I think so. Because it heightened my interest in animals." S11 "Yes, I think so. Because we can understand the topics in a fun way*." S6 who answered No, the reason for this was "*No, I don't think so. Because I like other subjects more*." stated as. In the research, the third question posed to students was "How did you find the activity?" The answers to the question are given in Table 2.

Table 2. Opinions on the question "How did you find the activity?"

Entertaining	S2,S3,S4,S9,S12,S15,S16,S17,S18,S20,S24,S25
Intriguing	S1,S7,S8,S10,S11,S14,S19,S22
Exciting	S6,S13,S21,S22,S26
Annoying	S5
Other	S27,S28

In Table 2, among the students who participated in the activity, 12 people stated that the activities were fun, eight people were interesting, five people were excited, one was annoying, and two people did not state any situation. S16, one of the students who found the activity fun, said, "*It was very fun, and it was fun to have barcodes and to bring a phone and watch the videos there*." One of the students who found it intriguing said, "S22 "*There were interesting parts during the activity. Because I got curious about the barcode sections*.". S21, one of the students who found it exciting, said, "*I was very excited when I got to know the animals. It aroused curiosity for me at other events*." S5 of the students who found it boring said, "*It was boring in some places. I did not understand some parts*". In the research, the fourth question posed to students was "Which activity do you enjoy the most?" The answers to the question are given in Table 3.

Table 3. Opinions on the question "Which activity do you enjoy the most?"

We know right wrongs	S6,S15,S19, S23,S27
Coding	S1,S3,S7,S9,S11,S13,S18,S28
Concept cartoon	S5,S12,S16,S20,S21,S24,S26
Let's write and introduce what we have learned	S2,S8,S10,S14,S17,S22
All	S25

In Table 3, five of the students who participated in the activity answered what we know to be true, mistakes were made by eight, coding by eight, concept cartoons by seven, and let's introduce what we learned, and one answered as all. S23, who stated that they enjoyed the activity of "*What we know right and wrong, I like what we know is right and wrong because it was nice to do the right thing for the animal we knew wrong*." S1 among those who stated that they enjoyed the coding activity said, "*I didn't like the coding activity very much, it was very different.*" S16, who stated that she enjoyed the concept cartoon activity, said, "*The concept cartoon activity based on argumentation was very entertaining because there were cartoon characters*." S8, who stated that she enjoyed the event, "*Let's write what we learned, let's promote it*" said, "I liked 3D because it was amazing." Stating that she liked all the activities, S25 said, "*I think they were all good because it was my first experience*." They replied in the form. In the research, the fifth question posed to students was "Do you think that doing such practical activities on subjects that you do not understand will make it easier for you to understand the subject?" The answers given to the question are given in Table 4.

Table 4. Opinions on the question "Do you think doing such hands-on activities will make it easier for you to understand the subject?"

Yes	S1,S2,S3,S4,S5,S6,S7,S10, S11,S13.S14,S15, S16, S17, S18, S21, S22, S23, S24, S25, S26, S28
No	S20

In Table 4, it is seen that 22 of the students who participated in the activity stated that such practices would make it easier to understand the subject, and one student answered no to this question. One of those who thought that similar applications would be beneficial on subjects that were not understood, S1 said, "*Yes, seeing it in 3D and having fun is very logical. It would be nice if it was about microscopic creatures*." S10 "*I think I don't understand the friction force. I would like this done*." S2 stated that "*These activities make it easier to understand, we repeat what we learned in the lesson*."

4. DISCUSSION AND CONCLUSIONS

In this study, guide materials enriched with digital contents prepared to comprehend the characteristics of birds in the fifth grade Living World unit, let's get to know living things, were developed. Developed activities were implemented and student opinions were taken. At the end of the study, almost all of the students stated that the activities were useful, and one student who did not find it useful stated this as not being able to reach digital content even though he had a phone. It is thought that the emergence of this situation may be due to the old phone of the student or the inability to use the technology. All students, except one student, think that it would be beneficial to carry out similar activities in other Science course subjects. The student, who thought that it would not be useful, stated that he liked other lessons more. It is also supported by many research results that guide materials are effective in learning the subjects in terms of their benefits (Çetinkaya & Taş, 2018; Kızılaslan, Aslan, Karakoç & Kapucu, 2022; Varinlioğlu et al., 2022). It has been concluded that the activities are fun, intriguing and exciting for students, but annoying for a student. According to the results of many studies, teaching with activities is fun for students (Kızılaslan et al., 2022). When the findings related to the problem of the activity that is most enjoyable in the study are examined, the coding activity comes first. Coding education is included in the 5th Grade Information Technologies and Software course (Ministry of National Education [MoNE], 2018). Therefore, it is thought that the students are familiar with the coding activity. The majority of those who like the coding activity are students who do not have a phone or tablet. It can be said that the reason for this is that digital content is not used in the coding activity or that they have encountered such an activity for the first time in science class. According to the results of the study on student views on coding education, coding activity is one of the activities that students find enjoyable (Sırakaya, 2018). The primary school students who participated in the study of Sırakaya, (2018) stated that they learned that coding is not only an activity performed on a computer or tablet, but also that they can be coded on paper. The second most popular activity is the concept cartoon activity. Although digital content was not used in this activity, it was determined that the majority of those who preferred this activity were students who had phones and tablets. The reason for this situation may be the use of common cartoon characters in concept cartoons due to the small age range of the student group. In the literature, many studies have been found in which students enjoy the use of concept cartoons (Kaçar et al., 2020) and positively affect students' attitudes towards Science (Atasoy, Toksoy & Calik, 2020; Norfarah, Mohd Ali, & Chong, 2019). In the third most popular event, let's write what we learned with augmented reality content and promote it. Except for one of the students who prefer this activity, the others are students with phones and tablets. As a result of many studies in the literature, it has been concluded that the application of augmented reality increases the interest and motivation in the lesson and the lesson is more enjoyable for students (Han, Jo, Hyun & So, 2015; Zhang, Sung,

Hou, & Chang, 2014). In the study, it was also concluded that most of the students stated that such practices facilitate understanding of the subjects, as they found the activities entertaining, intriguing and interesting. In line with these results, it is recommended to develop the digital competence infrastructure of the students in the activity applications enriched with digital contents and to prepare the guide materials that can be applied for different learning levels and subjects of the Science course by integrating them with digital contents.

Ethics Committee Decision

This research was carried out with the permission of Erciyes University Scientific Research and Publication Ethics Committee with the decision numbered 2023/49 dated 31.01.2023.

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THE LITTLE SWALLOWER'S ADVENTURES ON THE MIGRATION ROAD

The little swallow was born in Turkey. Summer is over and the season is autumn. It was time to migrate to warm lands before winter came. The little swallow was going on a long journey for the first time. From the day she hatched, her mother had taken good care of her, her feathers had grown and her wings had grown stronger. Her heart shuddered as she thought about what kind of journey awaited her. With the preparations completed, they set out. When the little swallow looks back, he sees that the sparrows have not come, he stays there, and he asks his mother in curiosity. Mom, why don't they come? His mother: “Baby, not all birds migrate, so they stay here. They will spend the winter here.” Along the way they cross mountains, hills, plains. It was a lot of fun to pass through the fallen trees along the way without hitting the leaves. After a long time, the little swallow tells his mother that he is tired. Then they take a break on the branch of a tree. The weather was warmer now. They had come to Africa. While the little swallow watches around, what can he see, an ostrich rising from the huge eggs. It was the first time he had seen such a creature. In fact, he thought he was wearing us out. It has two legs, it lays eggs, it has feathers, it has a beak. Biran wondered if it could be such a big bird and asked his mother. Mother yes baby. This bird's name is ostrich, he said, just then a cheetah started chasing the ostrich. The little swallow was very excited. He started yelling. Fly quickly, save yourself. But his effort was in vain. The little swallow was surprised to see that the ostrich could not fly. He was also very upset when he saw that the cheetah had caught the ostrich. “Friends, if you are wondering about the ostrich, if you want to watch the view I saw, scan the QR code on your phone.

Ostrich video

The long journey had exhausted the little swallow. One day they would spend time here and continue on their way. While watching around, he saw many birds such as crows, starlings, parrots, pigeons, eagles and vultures. Butterflies and bees flying in the air caught his attention. They could fly, too, but they didn't look much like themselves except for their wings. I wonder if butterflies and bees were also a species of bird? It was about to be evening and suddenly he sees black birds like themselves making very fast sudden movements around. Mom, these look a lot like us, what's their name? The little swallow's mother answers with a smile. They are bats, not birds. They are mammals and reproduce by giving birth to their young. They feed their young with milk, and at the same time, their bodies are covered with hairs, not feathers like us. The little swallow was so surprised that he thought he still had a lot to learn. "Friends, if you're curious about bats, scan the QR code on your phone."

Bats video

It was morning, it was time to go. Before they reach their destination, they encounter a sandstorm. They change their course to avoid being caught in a sandstorm. The sandstorm had passed, but they were lost. After traveling for a long time, the air begins to cool in the direction they are going. Snow and ice were starting to appear, I wonder if they were returning to Turkey by mistake. No, no, they accidentally got to the south pole when they lost their way. The little swallow couldn't believe his eyes as he stared intently at the landscape below. He was seeing penguins for the first time, and thousands of them together. When her mother sees the curious eyes of the little swallow, look, my child, these are a bird species. Like the ostrich, they cannot fly, their wings are tiny, and look, they also have eggs in the snow. The little swallow's beak remained open in surprise when he saw penguins walking slowly on land moving so fast through the water. Do mother birds swim by turning to mother? Yes, baby, some birds such as penguins and ducks can swim. “Friends, if you are curious about penguins, scan the QR code on your phone.”

Penguins video

The little swallow, read out of her amazement, was very cold. They are on their way to where they are going. Finally, the long and adventurous journey was over and they had reached their destination. The little swallow had learned many things on this journey. Did you learn new things like the little swallow? If you want to take a closer look at some bird species, click the 3D display section by scanning the QR code.

Penguin **Parrot** **Eagle**

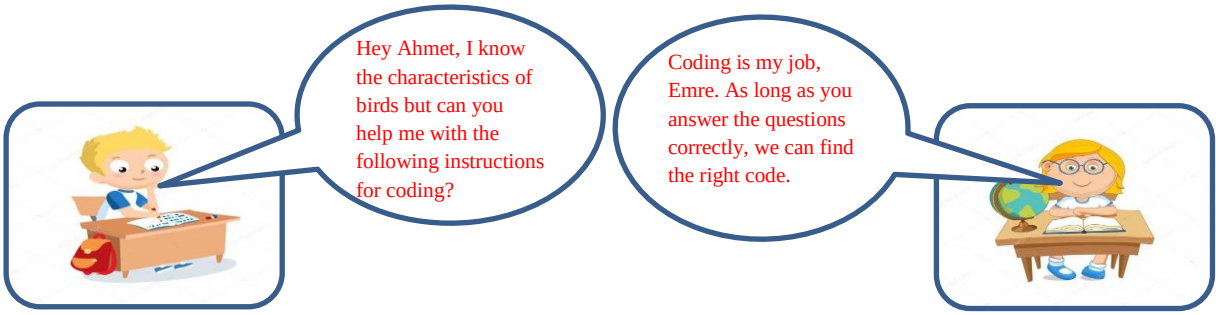
Misconcepted Activities That We Thought Were True

1) Identify the mistakes in the statements about the living organisms whose characteristics are listed in the table below and write the correct ones in the dotted spaces.

	**Penguin:** I am a fish swimming in water. I reproduce with eggs.	.....
	**Ostrich:** I can run very fast, but I cannot fly. I reproduce by giving birth.	.....
	**Butterfly:** I have wings so I can fly I am a bird.	.....
	**Bat:** I reproduce by giving birth. I am a bird species because I fly around.	.....
	**Chicken:** My body is covered with feathers. Although my species reproduces by eggs, I am not a bird species because I cannot fly.	.....

2) Imagine that you are a naturalist. While wandering in nature, you saw an undiscovered bird species. Utilizing the information you have learned about the subject, describe the bird species you saw using your imagination or draw a picture of it.

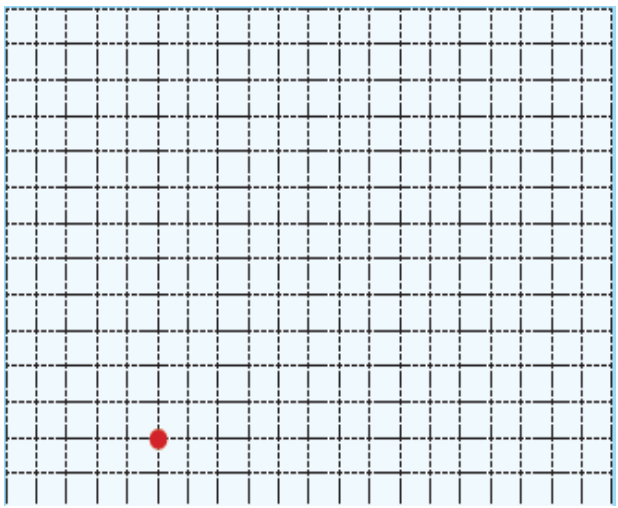
Coding Activity

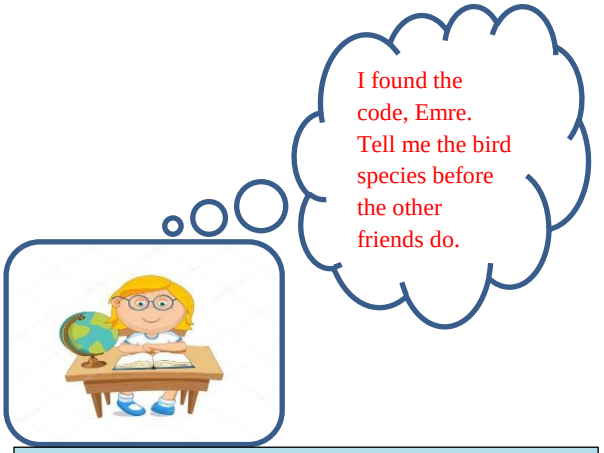


CODING INSTRUCTIONS

Circle the number and arrow below of the living organism that has the following characteristics. In one question, you may make more than one marking. Then, starting from the starting point on the gridded table, draw a line in the direction of the arrow next to the number as many as the circled number in the same question, starting from the left in the order of the questions. After the coding drawing is complete, write a bird species name starting with the letter of the resulting code.

Features	Ostrich	Eagle	Bat	Duck
I reproduce with eggs	1	2	4	2
I can fly	5	1	1	1
My body is covered with feathers	1	1	1	2
I swim in water	2	3	4	3
I am not a bird	3	5	4	4





So, what did you find?

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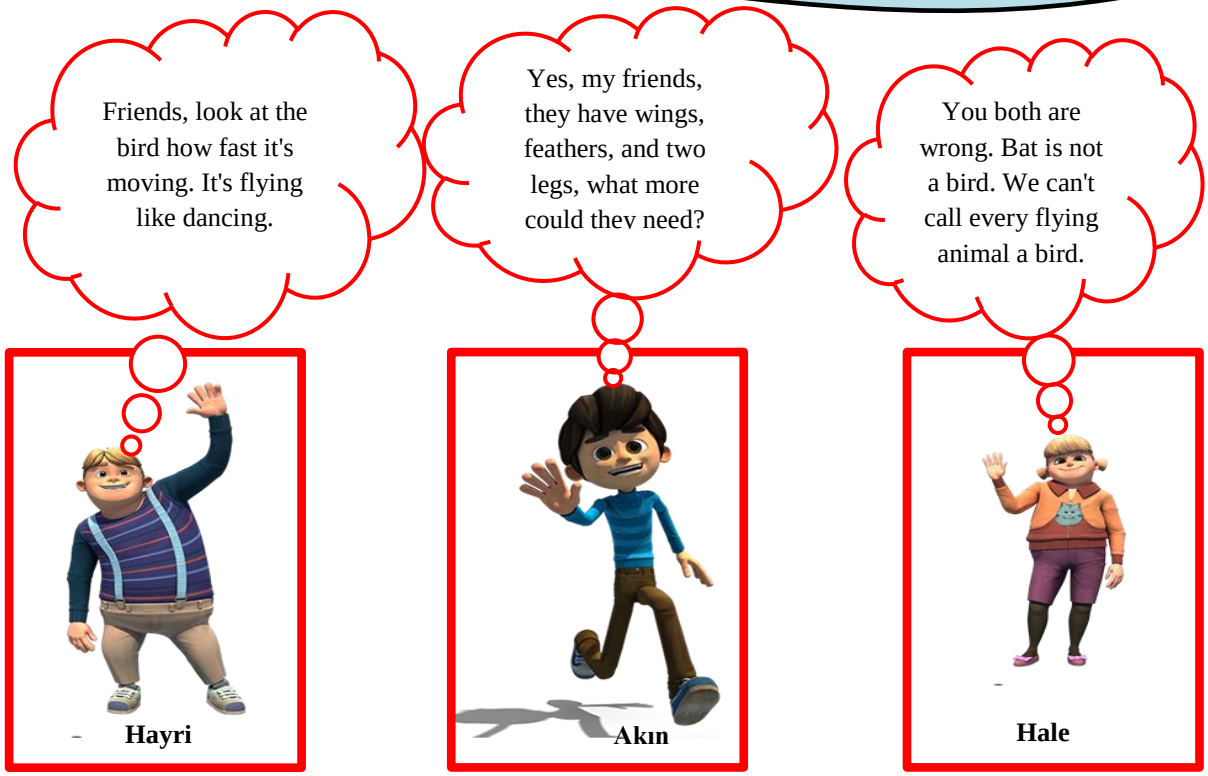
Argumentation-Based Concept Cartooning Activity "Characteristics of Birds"

Hayri, Akın, and Hale, the three-headed crew, were walking in the forest one day when Hayri saw a bat flying in the air. She watched it in amazement and called out to her friends.



What do you think, which one is right?

I agree with Hayri. Because:……...

I disagree with Hayri. Because:……..

I agree with Akin. Because:……

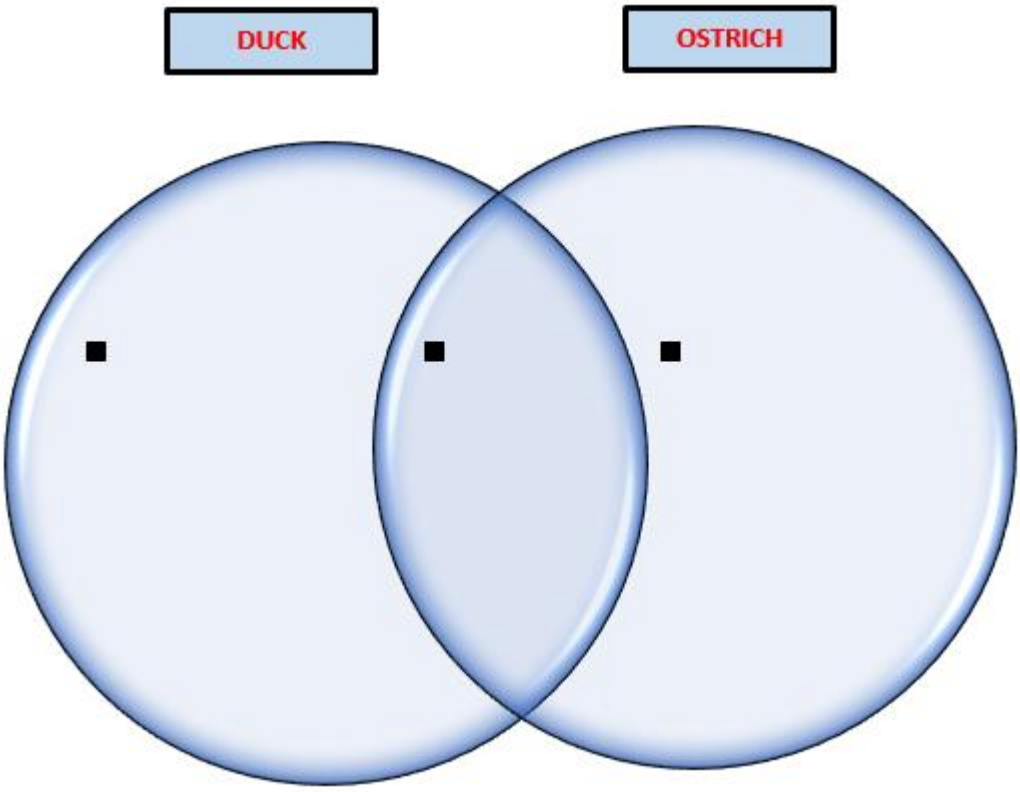
I disagree with Akin. Because:……...

I agree with Hale. Because:……

I disagree with Hale. Because:……

Let's Write and Introduce What We Have Learned

A- Write the common and different characteristics of duck and ostrich in the diagram given below?



B- Write down the features of the eagle in the 3D model provided by scanning the QR code. Then, stand next to the 3D model and shoot a video to promote it by mentioning these features.

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