



Students' views on digital system activities based on the 5e learning cycle model*

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Abstract

In this research, it was aimed to examine the views of the students by doing activities on the digestive system based on the 5E learning cycle model. This study was conducted with ten sixth grade students in the 2021-2022 academic year. Activities designed in accordance with the 5E teaching cycle model were applied to the students, and then semi-structured interviews were conducted over zoom to get the students' views. The data obtained in the interviews were analyzed by content analysis. As a result, the students stated that they found the activities instructive and educative, and that they wanted them to be applied in other subjects as well. In addition, students think that there are places that need to be changed in the activities and that the questions asked in the activity are especially difficult.

Keywords: 5E learning cycle, constructivist approach, digestive system

Introduction

Developing technology has also required change in education. The development of individuals in a society is also the development of society. Modern day distance learning is influenced by advanced technology which enables connection of thousands of learners. Study resources can be delivered instantly through internet in a wide variety of presentation methods and approaches (Gluoksnyte, 2022). In this context, an educational approach that gives importance to the development of the individual is necessary for societies. One of these approaches is the constructivist approach. Constructivist approach is student-centered and students are active in learning. The constructivist approach is basically based on associating learned information with past learning. The 5E learning cycle model is based on a constructivist approach. The model consists of five stages. These are: Engage, Explore, Explain, Elaborate, Evaluate (Bybee vd., 2006). Engage is the first phase of the 5E learning cycle. This is the phase in which the attempt is made to capture the student's interest and attention. They start focusing on events, situations, demonstrations and problems, which cover the abilities and content aiming for instruction. teachers can ask questions, look for solutions to problems and present discrepant events to engage learners (Bybee, 2006).

In the explore step, students are encouraged to work in a collaborative learning environment. At this stage, questioning, researching, testing predictions, forming hypotheses, and communicating with other peers are at the forefront (Bybee, 2006). In the explanation step, the teacher asks the students to explain. Teacher presents explanations directly. Students actively participate in the process. Students' listening to other students' experiences contributes to students' experience (Bybee vd., 2006).

In the elaborate step, students need experiences that will deepen the ideas they have acquired and the concepts they have learned. In this step, the concepts learned are adapted to the new situation (Bybee vd., 2006).

In the evaluation step, feedback is given to the students. In this way, students are aware of their deficiencies and have the opportunity to correct them (Bybee vd., 2006). Portfolios, performance-based evaluation, concept maps, models or diaries can be used in the evaluation phase.

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When the studies on the 5E learning cycle in the literature are examined, it is seen that there are studies examining the effects of students' achievement (Bunkure, 2019; Kaynar vd., 2009; Ong et al., 2020; Ong et al., 2021; Parveen, 2017; Sen ve Ozyalcın Oskay, 2017), attitudes (Garcia-Grau et al., 2021; Hokkanen, 2011) and critical thinking skills (Randani et al., 2019). However, no study was found on the digestive system at the sixth grade level, in which the 5E learning cycle was used. In this context, it is thought that this study will contribute to the literature.

The research question of this study is "What are the opinions of the sixth grade students about the activities on the digestive system based on the 5E learning cycle model?" The sub-questions determined within the framework of this research question are listed below.

Sub-questions;

1. Do you think the activities have positive and negative aspects? If so, what are they?
2. What was your favorite activity or activities among the activities? And why? Please explain.
3. Which of the activities would you like to do on other subjects? And why? Please explain.
4. If you had the opportunity to change the activities, what would you change?"
5. What are the situations in which you have the most difficulty in implementing the activities?"

METHOD

Research model

In this study, phenomenology, one of the qualitative research models, was used. (Creswell, 2016). Ten students at the sixth grade level studying in a secondary school participated in the research. Convenience sampling was used in this research. The students were given a code as S1, S2, S3, S4, S5, S6, S7, S8, S9 and S10.

Preparation and implementation of the activity

Four steps were followed in the preparation and implementation of the activities. First of all, the literature on the subject on which the activities will be prepared was examined. The objectives in the Science Program were determined. Within these objectives, activities based on the 5E learning cycle model were created. Finally, these activities were applied and the students' opinions about the activities were examined.

1. Literature review:

Studies on the misconceptions about the digestive system in the literature were examined (Andariana et al., 2020; Cucin et al., 2020; Tapia et al., 2023). The activities were designed based on the concepts determined in the literature that students had difficulties.

2. Examination of the objectives of the "Digestive System" unit:

Objectives for the 6th grade digestive system in the science program were determined and activities were prepared for these objectives. The objectives on the digestive system in the 6th grade curriculum are as follows:

- Explain the functions of organs in the digestive system using models.
- Concludes that nutrients must go through physical and chemical digestion in order to pass into the blood are given.
- Definitions of chemical and physical digestion are given.
- Information is given that enzymes take part in chemical digestion.
- The functions of digestive organs are explained.

3. Designing activities

The 5E learning cycle model is based on constructivist model. It is a model in which the student is active. For this reason, the activities designed based on this model must include activities in which the student is active. The 5E learning cycle model consists of Engage, Explore, Explain, Elaborate, Evaluate stages (Bybee, 2006). Two activities were designed and implemented for each step. A case story and a concept cartoon were used in the

engage stage. Augmented reality and experimentation were used in the explore stage. Animation and the text of karagöz-hacivat were used in the explain stage. Argumentation and models were used in elaborate stage. In the evaluate step, educational games called information bag and bingo were used.

4. Implementation of activities

One lesson hour (40 minutes), were given for the implementation of each activity. Care was taken to implement the activity in each step in the same day in successive courses. The activities were completed in ten lesson hours.

4.1.Engage stage:

Two activities titled 'The Story of the Tomato' and 'The Animals Talk' were planned and implemented in engage stage. Both activities were applied in one lesson hour.

4.1.1 The Story of the Tomato

In the first activity of the engage stage, a story was given to the students. In this story, the steps of digestion from the mouth of a tomato were told. The person who plucked me from the branch added me to what is called a salad and then threw it into her mouth, "and explained that digestion begins in the mouth. Then the teeth, pharynx and esophagus were mentioned. The pharynx and esophagus are described without using the names. 'We started to be shaken in the environment we were in with the secretion and we were even more fragmented. Now, none of us were separated from each other and we were completely mixed'" expressions were used to describe the digestion that takes place in the stomach and stomach. The intestines are mentioned in the part expressed in the story as "We have entered a narrow and winding road again." Finally, it is mentioned that some of the tomatoes in the story will be absorbed and mixed with the blood, and some will be thrown out. At the end of the story, tomato asked the students questions about this issue and asked them to think and comment on this issue. This story is designed with the purpose of "Concludes that nutrients must undergo physical and chemical digestion in order to pass into the blood".

4.1.2 Concept Cartoon

In the second activity of the engage stage, concept cartoon were included. The cartoon includes expressions about the digestive system from the mouths of a sheep, rabbit and chick. The phrase "digestion starts in the mouth" is written inside the sheep character speech bubble. The character of the rabbit said that "digestion begins in the mouth and ends in the large intestine." The character of the chick said that "digestion is the melting of food in the stomach". This concept cartoon is also designed with the purpose of "Concludes that nutrients must undergo physical and chemical digestion in order to pass into the blood".

4.2. Explore Stage:

In the explore phase, two activities titled 'Let's Observe the Digestive System Organs' and 'How Are Foods Digested' were planned and implemented. Both activities were applied in one lesson hour.

4.2.1. Let's Observe the Digestive System Organs

Two activities were included in the exploration phase. In the first of these activities, an activity with an augmented reality application was held. In the activity, the students were asked what the elements of the digestive system are and what their functions might be in the body. Then, the students examined the digestive system organs with a 4D augmented reality application. With this application, the students examined the stomach, liver, small intestine and large intestine, respectively. At the end of the activity, the students were asked which organs they saw and they were asked to draw these organs. This activity was carried out in line with the objective of "Explains the functions of the organs in the digestive system with models".

4.2.2. How Are Foods Digested?

An experiment was included in the second activity of the explain stage. In the experiment, various food materials were kneaded with water to stimulate digestion. In the continuation of the experiment, the absorption of the water in the kneaded materials was stimulated by the towel paper. At the end of the activity, the students were asked the questions "Which digestive system organs do the materials you use in the activity resemble?" and "Which organs and which secretions in the digestive system perform the task of the water added to the locked bag in the

experiment?”. With this activity, students make the inference that “in order for food to pass into the blood, it must undergo physical and chemical digestion.

4.3. Explain Stage

At the explanation stage, two activities called ‘Grape Gilbert and Digestive Journey and ‘Karagöz and Hacivat’ were planned and applied. Both activities were applied in one lesson hour.

4.3.1. Grape Gilbert and Digestive Journey

Two activities were mentioned in the explanation stage. In the first activity, an animation video was shown. The animation video is about a grape grain named Gilbert explaining the organs in the digestive system and the functions of these organs. In the continuation of the activity, the students were expected to write the names of the organs on a visual showing the digestive system of a person. Afterwards, the students were asked, 'Are there any organs that are visible in the video you watched in the activity, but are not found in the picture with the organs shown with signs? If yes, what are they?', “Where are the places where digestion does not happen in the picture with the organs shown with signs? and “What was the most interesting part of the video? Please explain.” After these questions are asked, it has been tried to carry out all the objectives of the digestive system, such as "Explains the functions of the organs in the digestive system with models", "Makes the inference that the nutrients must undergo physical and chemical digestion in order to pass into the blood" and "Explains the duties of the organs that assist digestion".

4.3.2. Case Story called “Karagöz and Hacivat”

In the second step of the explain stage, a case story on Karagöz and Hacivat was included. In case study, the organs of the digestive system and their functions, the organs that help digestion and their functions, physical and chemical digestion, and absorption are mentioned. Afterwards, Hacivat's questions to Karagöz were included and these questions were expected to be answered by the students. The same objectives of the digestive system that has been tried to carry out in the first step of the explain stage has been tried to carry out in this step.

4.4. Elaborate stage

In the elaborate stage, two activities called ‘argumentation?’ and ‘Let's create a model of the digestive system’ were planned and applied. Both of the activities were applied in one lesson hour but the preliminary process of the debate is not included in this period. The students made preliminary research at their home for this activity.

4.4.1. Argumentation:

Two discussion groups and a jury were selected for argumentation. In argumentation, it was told that each group should choose a digestive system organ and convince the jury that this organ is the most important organ for the digestive system. It is stated here that every organ in the digestive system is very important and the aim is to convince the jury of the importance of the organ they describe, rather than finding the most important organ. At the end of the activity, all students were asked, “Which organ do you think is the most important organ in digestion? Why?”, “Is it important in other organs in the digestive system? Why?” and “What are the functions of the organs described in the digestive system?” were asked. At last, in order to avoid misconceptions in students, it was reminded that every organ in the digestive system is very important and that the aim is not to find the most important organ.

4.4.2. Let's Create a Digestive System Model

In the second activity of the evaluate stage, the students were asked to create a digestion system model. Then the students were asked to show the digestive system organs on the model. This activity aims the functions of the digestive system organs using models.

4.4. Evaluate Stage:

During the evaluation stage, two activities called 'Information Bag' and 'Bingo' were planned and applied. Both activities were applied in one lesson hour.

4.5.1. Activity called Information Bag

In this activity, papers were given to the students and they were asked to write what they know about the concepts of "mouth, pharynx, esophagus, stomach, small intestine, large intestine, anus, gall bladder, pancreas, chemical digestion, physical digestion". Then, groups of five students were formed and time was given for the groupmates to read each other's paper and discuss their own mistakes and the mistakes of their groupmates. In this way, students had the opportunity to correct their misconception.

4.5.2. Bingo

In the second activity of the evaluate stage, the bingo activity was applied to the students. In this activity, bingo papers similar to the bingo game but containing notions related to the digestive system were prepared. Bingo papers were given to the students and the students were asked questions whose answers corresponded to a notion on the papers. Students that found the correct answer covered the notion corresponding to the correct answer with a piece of paper. When the questions are finished, the student who has closed all the answers correctly won the game. In this activity, questions about digestive system organs, auxiliary digestive organs and absorption were asked. In other words, the activity was prepared considering that it would be suitable for all three objectives of the subject. These activities were applied respectively in the teaching of the digestive system in the science lesson. Finally, semi-structured interviews were conducted with ten volunteer students via Zoom.

5. Findings

The digestive system was handled with activities in line with the 5E teaching cycle model, and then semi-structured interviews were conducted to get the opinions of the students about these activities. Codes were created from the answers of the students. First of all, the students were asked what the positive and negative aspects of the activities were. Positive opinions are given in Table 1.

Table 1: Students' opinions on the question "Do you think the activities have positive aspects? If so, what?"

Codes	Student
Develops imagination	S1
meaningful learning	S1,S2,S4,S6,S8,S9
Enjoyable	S2,S3,S8,S9
Competitive	S2
permanent learning	S3,S4
Realistic	S6
Useful	S10

As seen in Table 1, the majority of the students stated that the activities provided meaningful learning. In addition, they found the activities enjoyable and mentioned that they provided permanent learning. S3 expressed this situation as follows. *The activities provided permanent learning and were also fun.*

Negative opinions are given in Table 2.

Table 2: Students' opinions on the question "Do you think the activities have negative aspects? If so, what?"

Codes	Student
Contains long text	S1
Contains more information	S2
Limited time	S2
Confusing informations	S2
Difficult questions	S2
Similar questions	S2

As seen in Table 2, the students stated that the activities included long texts and that they found some activity questions difficult and confusing. The majority of the students did not indicate a negative aspect. These students generally mentioned that they liked the activities or that such a factor did not come to their minds at that moment.

In the second research question, “What were your favorite activity or activities among the activities carried out?” were asked. First, the activities that students liked were learned. The answers given by the students are given in Table 3.

Table 3: Students' opinions on the question "What was your favorite activity or activities among the activities?"

Codes	Students
Bingo	S1,S4, S10
Animation	S2,S7
Experiment	S2,S5
augmented reality	S2,S7,S8
concept cartoon	S3

When the student responses are examined, it is seen that the most popular activity is bingo and Augmented reality. However, the students did not mention the activities called 'The Story of Tomato', 'Debate', 'Let's Create a Digestive Model' and 'Knowledge Bag' in this section. In addition, the students were asked why they liked these activities, which they mentioned as their favorite activities. The answers of the students are given in Table 4.

Table 4: Students' opinions on the question " What is your reason for liking the activities?"

Codes	Students
Instructive	S1, S10
includes game	S2,S10
Enjoyable	S2,S7
Funny	S2,S5
Includes questions	S2,S7,S8
Like a competition	S3

When the answers of the students were examined, two students stated that they liked the activities because they found it instructive.. For example, S1 expressed her opinion as follows. It was instructive because I observed the organs realistically in the activity 'Let's observe the digestive system organs' using an augmented reality application. Additionally, in the concept cartoon activity called 'Animals Talk', the speaking situation of animals is fun for students. The opinion of S2 is as follows. *The talking of the animals was funny. Also, Grape Gilbert accidentally got into his windpipe and coughed. So it was fun.*

In the third research question, the students were asked, “Which of the activities would you like to do on other subjects as well? question was posed. The answers of the students are given in Table 5.

Table 5: Students' opinions on the question "Which of the activities would you like to do on other subjects? Please explain.?"

Codes	Students
Solar system	S1
Systems	S2,S8
Force and motion	S4,S9
Respiratory system	S5
Skeletal system	S6,S7
Excretory system	S10

From Table 5, it is seen that the subjects expressed by the students are generally the subjects of the systems unit. Students were also asked why they chose these topics. Their answers are given in Table 6.

Table 6: Students' opinions on the question “What is your reason for wanting to do the activities on other subjects as well?”

Codes	Students
Contains more concepts	S1,S3
Reinforce the topic	S2
Liking the subject	S3,S8,S10
Have a similar topic	S5

When Table 6 is examined, among the reasons why the students want to apply activities in other subjects is that these subjects contain too many concepts and they want to reinforce the subjects. One of the students explained this situation as follows. *The subject of systems is a difficult subject and includes many concepts. Therefore, such activities should be done on systems unit.*

In the fourth research question, the question "If you had the opportunity to change the activities, what would you change?" was asked to the students. Student answers are given in table 7.

Table 7. Students' opinions on the question " If you had the opportunity to change the activities, what would you change?"

Codes	Students
reducing the case story	S1,S3
adding video	S2,S3
extending the case story	S5
adding easy questions	S4,S6, S8
Changing the order of activities	S7

When the answers of the students are examined, it is seen that two students want to shorten the case story and one student wants to lengthen it. While eight students expressed their opinions to make changes, two students preferred not to make any changes.

In the fifth research question, the question "What are the situations in which you have the most difficulty during the implementation of the activities?" was asked to the students. The answers given by the students to this question are shown in Table 8.

Table 8. Students' opinions on the question "What are the situations in which you have the most difficulty during the implementation of the activities?"

Codes	Students
Limited time	S6
Inability to understand the activity	S1
Inability to see images clearly in augmented reality	S2
Workload in group work	S3
Difficult questions	S4,S5,S6,S7,S8
Inadequate preparation	S6,S7

From Table 8, it was seen that the students had the most difficulty in answering the questions. In addition, they mentioned that the time was not enough, they could not understand the activities well, they did not make enough preliminary preparations and they had difficulty in doing group work. One of the students explained this situation as follows. S6: Time was not enough. Some questions were difficult. I hadn't prepared for activity.

Discussion and Conclusions

The following results were obtained by examining the findings obtained in this study. The students were asked about the positive and negative aspects of the activities. When asked about the negative aspects of the activities, most of the students did not mention a negative situation. As a result of the study, the students stated that they found some activity questions difficult and that they thought that more information was given in some activities. Similar results were also found in the literature (Bilgin et al., 2013).

The students mentioned that the activities are fun and provide meaningful learning as positive aspects. Similar results were also found in the related literature (Eroglu and Bektas, 2021; Garcia-Grau, 2021). Additionally in the literature, it has been determined that the 5E learning cycle model has positive effects on students' academic achievement (Bunkure, 2019; Kaynar et al., 2009; Ong et al., 2020; Ong et al., 2021; Parveen, 2017; Sen and Ozyalcın Oskay, 2017), attitude (Garcia-Grau et al., 2021; Hokkanen, 2011) and motivation level (Bilgin et al, 2013).

In the second research question, the students were asked which activities they liked. Most of the students answered bingo. In general, students think bingo is fun. Case story, augmented reality, animation and concept cartoon activities are also popular activities. The studies in which these methods are used in the literature are liked by the participants and found to be entertaining (Aslan et al., 2021; Chiang et al, 2014; Karagozlu and Ozdamli, 2017; Yıldırım, 2021).

In the third research question, the students were asked what other subjects they would like to do the activities in the study. The students stated that they wanted to do the activities in the systems unit. The students stated that the reason for preferring the subject of systems is that this subject contains more concepts. It is emphasized in various studies that students have misconceptions about systems and the activities should be done on this subject (Andariana et al., 2020; Aydin and Ural Keles, 2018).

In the fourth research question, the students were asked what they would like to change if they had the chance to change the applied activities. Some students stated that they wanted to shorten the case story because they had difficulty in understanding and could not remember the information in the case story. Some students, on the other hand, stated that a longer case story would be more entertaining and interesting because they thought it was an entertaining text.

In the fifth research question, the students were asked about the situation in which they had the most difficulty while doing the activity. Most of the students stated that they had difficulty in answering the questions. The reason for this was that they did not have enough time to answer the questions, they had difficulty in understanding some activities and they had difficulties in group work. Similarly, in the literature, factors such as time and content knowledge are expressed as difficulties in the application of the 5E method (Biber et al.,2015; Polgampala et al., 2016).

Recommendations

Considering the results obtained in this study, the recommendations for future research are as follows:

- The study was conducted at a public school located in a rural area.. The study can be repeated at different school districts and different school types.
- The study can be repeated at different educational levels.
- The method can be repeated in different units or subjects
- It has been determined that the students have difficulties in the time allocated to the activities.
- The study can be repeated by extending the activity period.

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