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## **Students' Opinions on the Instructional Material Developed with Regard to Integral**

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### **Abstract**

The purpose of this study is to evaluate students' opinions about the instructional material (FlashRie) developed with Flash programme for "area applications in integral." To this end, the study was conducted with 20 12-grade students selected on a voluntary basis. The study was a special case study which is one of the qualitative study methods and a semi-structured interview form consisting of 5 open-ended questions and prepared by researchers was used as data collection tool. Data obtained from the semi-structured interview form was analyzed through descriptive analysis. As a result of the study, all the participants stated that they actively participated in the lesson with FlashRie and they never lost their attention throughout the lesson. In addition to this, most of the participants emphasized that their learning was more permanent since FlashRie is visual and it does not directly provide the solutions of the questions but directs one to solution with clues. Furthermore, some of the participants expressed that they lost their prejudice against mathematics and that they started liking mathematics after using this material. Participants underlined that they would like to use this material and other similar ones also in other subjects of mathematics. However, majority of the participants argued that it would be more efficient to use FlashRie in company with a teacher in class environment than using it on their own.

Keywords: instructional material development, definite integral, students' opinions.

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## 1. Introduction

Together with technological advancements, computer literacy has increased more and more and computers have started to become an integral part of educational activities [7]. With the integration of computers to existing education program, Computer Assisted Instruction has emerged. Author defines computer assisted instruction as a teaching method in which computer is used as the medium where learning takes place and which reinforces instruction period and student motivation and from which each learner can benefit depending on their own learning speed [42]. Crowded classrooms which are the result of traditional education system, inadequate equipment, increasing amount of information and importance of individual differences and competencies make it necessary to use computers effectively in education system [4]. As a result, in the literature it is possible to find various studies that argue for the use of computers in education activities and that have concluded that computer assisted instruction positively affect students' academic success and attitudes towards the course [7, 11, 20, 25, 29, 37, 38, 43].

For effective computer assisted instruction, one needs effective instructional software as well [3]. Instructional software are instructional materials which aim to teach a certain subject or problem solution in a more audiovisual way using the medium of computers [26]. Instructional materials developed are to be simple and understandable. The contents of instructional materials are to be prepared according to education program. The texts and audiovisual elements are to be suitable for pedagogical characteristics and real lives of students [39]. Besides, instructional materials are to be of quality in terms of use and design. The visual quality of the materials should attract students' attention but not distract them. For students to use the material easily, it should feature users' guide and help menu [40]. Therefore, Computer Assisted Instructional materials are to serve their purposes, well-designed and integrated to school's educational program. Thus, preparation, development and assessment of instructional materials require very careful and rigorous study [18].

In parallel with development in computer technology, computer assisted instructional materials develop continuously. Materials which used to be only composed of texts are now enriched with multimedia technologies like audio, animation and graphics [44]. One of the most frequently used multimedia technologies is animation [16]. Animation is a Latin word and it means to animate [22]. According to another definition, animation is the process of enlivening objects to teach concepts which are difficult to explain verbal expressions or stand still pictures [31].

Instructional materials in which animation technique is used help students to and concretize abstract concepts and envision them [5]. Therefore, concretization of abstract things through animation creates a positive effect [28, 32]. Besides, in materials prepared with animation technique information is presented both via written text and audio-visually. Pettersson emphasizes that if information is presented visually, aurally and verbally, learning is achieved at the highest level and long lasting learning is achieved [41]. Because 60% to 65% of information learned audio-visually is remembered. Such a great contribution of audio-visual materials on learning makes instructional materials with animations important [21]. When relevant studies in the literature are reviewed, it is seen that these materials increase students motivation, make positive contribution to their learning and help development of scientific process skills [14, 15, 24, 27, 30].

Mathematics as a system is an abstract notion which is composed of structures and connections and which include sequential abstractions and generalizations made up of these structures and connections. It is known that students find mathematics difficult as it is difficult to acquire abstract notions [9]. One of the mathematics subjects which include abstract concepts is integral. The concept of integral which is one the important subjects in secondary level last year mathematic education is examined under the headings of indefinite and definite integral [17]. The difficulty in understanding the concept of integral is accepted by many researchers. Especially, in the teaching definite integral, many students do routine operations to calculate definite integral or the derivative of the function but they have great difficulties in interpreting and making sense of this calculation [10, 23]. The reason for

this is that in the teaching of definite integral, importance is attached to the acquisition of process skills and the definitions of the concepts are given at abstract level [1]. The concretization of the concepts of definite integral and Riemann sum by visualizing them on the computer will substantially help students make sense of these abstract concepts [2]. Therefore, there is a need to develop computer assisted instruction materials for “field applications in integral” topic. Besides, in recent year education programs emphasized that computer assisted education materials are to be used in learning/teaching process [33, 34].

In line with this, an instructional material was developed using for the teaching of “Field Applications in Integral, which is one of the notoriously difficult subject for students. The material was developed by the researchers using Flash software and called FlashRie. Besides, FlashRie was applied in real classroom environment and students’ opinions were taken and evaluated.

## 2. Method

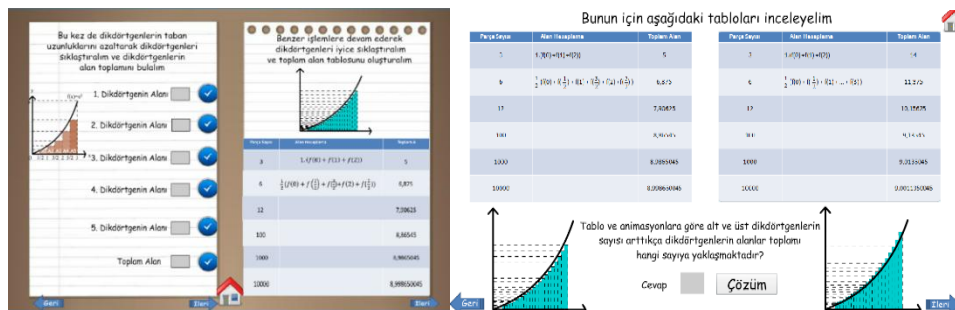
This study was conducted with the case study method, which is one of the qualitative study methods, in order to evaluate students' opinions about FlashRie instructional material developed for "area applications in integral". Case study is a method, which investigates the case that is studied within its own life framework and which is used in the cases when there are no distinctive borders between the case and the environment it happens within and there are more than one evidence or data source [45].

### 2.1. Instructional material

FlashRie was prepared by the researchers using Flash software. This instructional material was developed in accordance with the gainings of "area applications in the integral" in 12<sup>th</sup> grade math curriculum such as "It explains the Riemann sum and the determined integral by means of the area remaining under the curve and calculates the area by using the Integral". FlashRie's content includes activities, pictures, solved questions and evaluative questions about the subject.

It was tried for FlashRie to be interactive as much as possible in order to provide active participation of the students. For this purpose, FlashRie includes questions intended for the exploration of the students, buttons on which they can write their answers and check them and some clues according to their answers. Also, FlashRie was designed in a way that students will be able to use by themselves or with the guidance of the teachers.

Some screenshots of activities in FlashRie was displayed in Figure-1



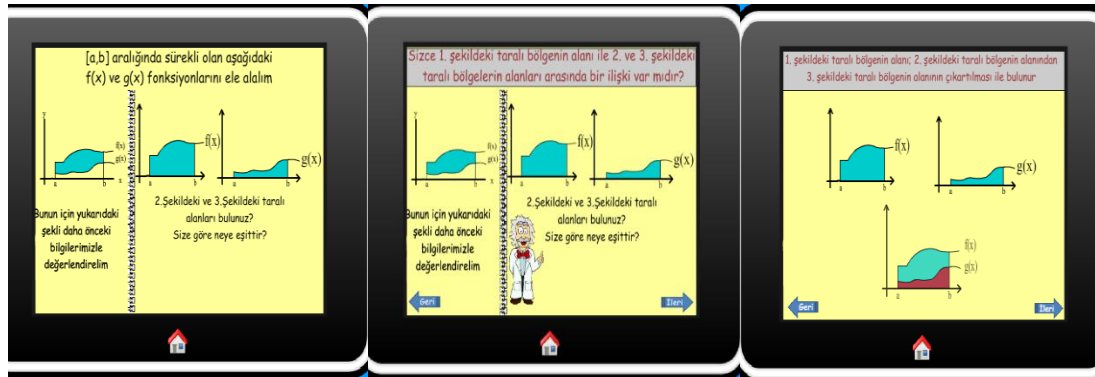


Figure 1. Screenshots of the activities designed for the gaining of "It explains the Riemann sum and the determined integral by means of the area remaining under the curve and calculates the area by using the integral" and of "It calculates the area by means of integral".

## 2.2 Participants

This study was conducted with 20 twelfth grade students during spring semester of the 2013-2014 educational year in order to evaluate the students' opinions about the developed instructional material FlashRie. Students participating in the study used the developed instructional material in the lecture environment were selected from among 30 twelfth grade students based on the principle of voluntariness. 12 of the students were girls while 8 of them were boys.

## 2.3. Collection of data

Research data was collected with the semi-structured interview form made of 5 open-ended questions in order to investigate students' opinions about FlashRie. Open-ended questions in the interview form were prepared in order to collect the data appropriate for the purpose of the study and opinions of the experts were obtained about the subject.

The questions in the interview form were specified below:

- What do you think about learning with FlashRie?
- What do you think about learning with activities and clues in FlashRie?
- Did FlashRie cause a change on your opinion about mathematics?
- Would you like to use this software and similar ones about other math subjects? Why?
- Do you think you can learn a subject on your own independently of your teacher and without getting any help from FlashRie or similar software? Why?

## 2.4. Data analysis

Answers given by the students to the questions in the interview form were investigated in detail while analyzing students' opinions about FlashRie at the first step. At the end of the investigations, two students who gave conflicted answers to the questions were excluded from the evaluation. At the second step, answers given by students to every question in the interview form were classified according to similarities and divided into categories. Reliability and validity of the study was ensured at the third step. Yıldırım and Şimşek (2011) expressed that reporting in detail how the data and results were obtained in qualitative studies was an important criterion for validity. Accordingly, data collection and the process of analysis were explained in detail in this study. Data collected from the

interview form was analyzed firstly by the researchers and then by a professor, who is an expert in this area, in order to ensure the reliability of the study.

### 3. Findings

In this section, qualitative data obtained from the interview form was interpreted by being analyzed in sub-headings according to the questions in the interview form and were presented in tables.

#### 3.1. Findings obtained from the interview form

Answers given by the students participating in the study to the question “*What do you think about learning with FlashRie?*” were categorized. Categories that were created and the number of students representing these categories were specified in Table 1.

Table 1. Categories and the number of students representing these categories

Categories	Number of students
Active Participation / Attention	20
Permanent Learning	13
Pleasant	9
Facilitating Learning	6

As it is seen in the Table 1, "Active Participation/Attention", "Permanent Learning", "Pleasant" and "Facilitating Learning" categories were created as a result. All these categories represent positive opinion about FlashRie. All of the students, who participated in the study, (100%) expressed that they were active while learning with FlashRie and their did not lose attention while 13 of them (65%) expressed that they learned permanently since FlashRie is visual, 9 of them (45%) expressed that it was pleasant to learn using FlashRie and 9 of them (30%) expressed they learned more easily by using FlashRie.

#### **Students' opinions with regard to "Active Participation/Attention" category:**

*"FlashRie ensures everyone participates in the lesson actively so we do not lose attention during the lesson."* (S6)

*"We do and find out about everything on our own. Therefore, we can focus completely on the lesson."* (S20)

#### **Students' opinions with regard to "Permanent Learning" category:**

*"I think FlashRie is mode permanent since it is supported by visuals."* (S5)

*"I think I learn more permanently since it addresses both the eyes and the ears."* (S16)

#### **Students' opinions with regard to "Pleasant" category:**

*"I was getting bored sometimes when our teacher was teaching. But it is pleasant to learn with FlashRie."* (S3)

*"Learning became much more pleasant like this."* (S1)

#### **Students' opinions with regard to "Facilitating Learning" category:**

*"It is easier to learn with FlashRie. Because it is both visual and the necessary explanations are given appropriately."* (S10)

*“FlashRie is like it simplifies the subject more. That is why I learned more easily.” (S12)*

Answers given by the students participating in the study to the questions *“What do you think about your learning with the activities and clues in FlashRie?”* were categorized. Categories that were created and the number of students representing these categories were specified in Table 2.

Table 2. Categories and the number of students representing these categories

Categories	Number of students
Materializing	8
Exploring	7
Encouraging	6
Arousing Interest	4
Reinforcing/Repeating	3

As it is seen in Table 2, "Materializing", "Exploring", "Encouraging", "Arousing Interest" and "Reinforcement/Repeating" categories were obtained as a result. All these categories represent positive opinion about FlashRie. 8 of the students participating in the study (40%) expressed that they were able to materialize since the activities were visual while 7 of them (35%) they were able to explore the concepts since they progressed step by step, 6 of them (30%) expressed the clues that were given encouraged them to solve the problem, 4 of them (20%) expressed that the activities in FlashRie were arousing interest and 3 of them (15%) expressed that they had the chance to reinforce since they could watch the activities again.

**Students' opinions with regard to “Materializing” category:**

*“It was very difficult for us to visualize and find a solution when the teacher taught us. Math does not seem so abstract to me since FlashRie is visual.” (S2)*

*“The things that were told did not remain on paper since it was visual. I can visualize things. Thanks to this, I comprehended the subject better.” (S14)*

**Students' opinions with regard to “Exploratory” category:**

*“We know what we do and where and why we do it since the activities are done step by step. For this reason, we explore the concepts instead of memorizing them.” (S20)*

*“Small steps taken during activities ensured me to discover rules.” (S16)*

**Students' opinions with regard to “Encouraging” category:**

*“Getting clues instead of directly looking at the solution when I had difficulties about solving the problems encouraged me to solve the question.” (S4)*

*“I think that small clues that were given had an encouraging effect.” (S10)*

**Students' opinions with regard to “Arousing Interest” category:**

*“Questions given as puzzles and animations I encountered while conducting activities aroused interest in me.” (S8)*

**Students' opinions with regard to “Reinforcement/Repeating” category:**

*“FlashRie has a nice feature; we can watch it again and again when we do not understand something or when we want to repeat. Thus, we can reinforce the learning.” (S7)*

Answers given by the students who participated in the study to the question “*Did FlashRie cause a change on your opinion about mathematics?*” were categorized. Categories that were created and the number of students representing these categories were specified in Table 3.

Table 3. Categories and the number of students representing these categories

Categories	Number of students
Changing the Negative Attitude	10
Reinforcing the Positive Attitude	5
Not Changing the Positive Attitude	4
Not Changing the Negative Attitude	1

As it is seen in Table 3, "Changing the Negative Attitude", "Reinforcing the Positive Attitude", "not Changing the Positive Attitude" and "Not Changing the Negative Attitude" categories were created. Among these, "Changing the Negative Attitude" and "Reinforcing the Positive Attitude" categories represent the positive opinions about FlashRie while categories of "Not Changing the Positive Attitude" and "Not Changing the Negative Attitude" represent the negative opinions about FlashRie. 10 of the students participating in the study (50%) expressed that their negative attitude about math changed positively after they learned with FlashRie while 5 of them (25%) expressed their positive attitude about mathematics were reinforced after learning with FlashRie, 4 of them (20%) of them expressed their positive attitude about mathematics did not change at all after earning with FlashRie and 1 of them (5%) expressed his negative attitude about mathematics did not change after learning with FlashRie.

**Students' opinions with regard to “Changing the Negative Attitude” category:**

*“I did not like mathematics at all. Now I do.” (S8)*

*“My prejudice against mathematics was overcome. Mathematics is not hard for me anymore.” (S5)*

**Students' opinions with regard to “Reinforcing the Positive Attitude” category:**

*“Mathematics was pleasant for me. It became even more pleasant now.” (S1)*

*“I was interested in mathematics. But now I am even more interested in it.” (S17)*

**Students' opinions with regard to “Changing the Positive Attitude” category:**

*“I like mathematics since my childhood. My opinions did not change at all.” (S10)*

*“I have always liked mathematics. I still like it, there is no change.” (S12)*

**Students' opinions with regard to “Not Changing the Negative Attitude” category:**

*“I never liked mathematics. I still do not like it.” (S19)*

Answers given by the students who participated in the study to the question “*Would you like to use this software and similar ones about other math subjects? Why?*” were categorized. Categories that were created and the number of students representing these categories were specified in Table 4.

Table 4. Categories and the number of students representing these categories

Categories	Number of students
Using It to Learn Other Math Subjects	16
Using It to Reinforce Other Math Subjects	3
Not Using It for Other Math Subjects	1

As it is seen Table 4, "Using It to Learn Other Mathematics Subjects" category representing students' positive opinions, "Using It to Reinforce Other Math Subjects" category indirectly

representing students' positive opinions and "Not Using It for Other Math Subjects" category representing students' negative opinions were created as a result. 16 of the students who participated in the study (80%) expressed that they wanted to use this software and the similar ones while learning other math subjects while 3 of them (15%) expressed that they wanted to use such software to reinforce at home the subjects they learned at school and 1 of them (5%) expressed he did not wanted to use such software since he wanted to touch a book while learning.

**Students' opinions with regard to "Using It to Learn Other Mathematics subjects":**

*"Yes, I think about it. It is visual and I can visualize the subject. In addition to that, its drawings are very smooth and easy to comprehend."* (S11)

*"I would like to use it for that. I learn more easily that way."* (S15)

**Students' opinions with regard to "Using It to Reinforce Other Mathematics subjects":**

*"I may use it to reinforce the subject after our teacher teaches us the subject at school."* (S3)

*"It can be used to study or make repetitions at home."*(S7)

**Students' opinions with regard to "Not Using It for Other Mathematics subjects":**

*"No, I do not think I will use it. I think it is much better to touch and scribble a book."* (S19)

Answers given by the students to the question *"Do you think you can learn a subject on your own independently of your teacher and without getting any help from FlashRie or similar software? Why?"* were categorized. Categories that were created and the number of students representing these categories were specified in Table 5.

Table 5. Categories and the number of students representing these categories

Categories	Number of students
Learning with FlashRie Under the Guidance of Teachers	15
Learning with FlashRie on Your Own	5

As it is seen in Table 5, "Learning with FlashRie on Your Own" category representing the positive opinions and "Learning with FlashRie under the Guidance of Teachers" category indirectly representing positive opinions were created as a result. 15 of the students who participated in the study (75%) expressed that they wanted to work with their teachers since they thought FlashRie would not be able to answer every question they had in mind. 5 of the students (25%), on the other hand, expressed they could learn on their own with FlashRie since they understood subjects and materialized concepts better using FlashRie.

**Students' opinions with regard to "Learning with FlashRie under the Guidance of Teachers" category:**

*"No, I do not think I will use it. We must have our teachers with us to solve the problems in our minds. It is better if we have our teachers with us."* (S3)

*"It will be better with our teacher in our classroom with us. Our teacher can answer when we do not understand something or I have difficulties understanding it but we cannot get the answer we expected from this software and the ones similar to it."* (S9)

**Students' opinions with regard to "Learning with FlashRie on Your Own" category:**



*“Yes, I can learn. It is easy to learn with FlashRie since it is visual. In addition to that, I am the one who gives the answers while working with FlashRie. For this reason, I can learn without my teacher being near me.” (S10)*

*“Yes, I think about it. It is explained in an understandable manner. Also, I can visualize since it is visual.” (S14)*

#### 4. Discussion and Conclusions

In this study, which is undertaken to contribute to the studies for the development, application and assessment of computer assisted instructional materials, which have become more and more prominent in parallel with change in the understanding of instruction, the opinions of the students who received education via FlashRie, which is an instructional material developed by the researchers, are evaluated. When the opinions of students who took part in the study with regard to learning FlashRie were examined, it was seen that students had positive opinions with their learning experience.

When the views of the students, who took part in the study, with regard to their experience learning with FlashRie are examined, it was seen that most of the students were of the opinion that they actively took part in the lesson when learning with FlashRie, their attention was not distracted and learning with FlashRie was fun. Besides, the participants also stated that the activities in FlashRie concretized the concepts and enabled students to explore these concepts and thus they learnt easily and more permanently. When the views of the student in this study were generally examined, it was seen that the views that FlashRie instructional material played positive role in the students' learning stood out. This result is supported with the conclusions of other studies that computer assisted instructional materials and learning environments had positive effects on the learning process of students [8,12,13,16,19,24,27,28,30,32,36,46].

When the attitudes of the students who took part in the study towards mathematics are examined, it is seen that 10 of the 11 students who had negative attitudes towards mathematics changed their attitudes to positive after instruction with FlashRie and the attitudes of 5 students out of 9 students who had positive attitudes towards mathematics were reinforced after instruction with FlashRie. When generally examined, it can be said that the attitudes of the students taught with FlashRie about mathematics changed positively. In similar studies, it was concluded that computer assisted instructional materials and learning environments influenced students' attitudes towards the course positively [6,35].

Besides, most of the participants stated that they would like to use FlashRie and similar software in learning other mathematics topics as well. However, most of the participants emphasized that such software would be more effective when used together with teachers rather than alone. Participants stated the reason for this as the inability of the software to answer all questions in students' minds. This result, which provides clues for the understanding of web-based distant education, was also found in other studies in the literature [19,35,36].

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