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THE EFFECT OF A COMPUTER ASSISTED INSTRUCTION METHOD ON ACHIEVEMENT IN LINEAR EQUATIONS AND GRAPHS

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Abstract:
This study was carried out to examine the effects of a Computer Assisted Instruction (CAI) method on the academic success of students in the learning of linear equations and graphs, and also to determine the views of students about the use of GeoGebra in the teaching and learning of mathematics. The study consisted of two different classes of 7th grade elementary school students. One of the classes was chosen as the treatment group in which the CAI method was used, while the other class was chosen as the comparison group, in which a conventional teaching method was used. This study was carried out using a Triangulation design, a type of mixed research design. The mathematical topics were linear equations and graphs. Data were obtained from a knowledge test, from an open-ended questionnaire, and from focus-group discussions. As a result of the data analysis, it was found that the CAI method positively contributed to the success of teaching linear equations and graphs, when compared to the conventional teaching method. In addition, students stated that lessons in an environment of CAI become more enjoyable, and that their motivation and interest in the lessons increased. Students also indicated that it became easier to visualize, and give meaning to topics/concepts, and that their learning was more permanent in a CAI environment.

Keywords: GeoGebra, linear equations and graphs, computer assisted instruction

1. Introduction

The field of technology is developing as a result of rapid changes in society. Developments in science and technology affect education and social systems as much as they affect the economy. Information has played a key role in economic development, and an information society has emerged as a result of the development of information technology [1]. According to Baki [2], Information and Communication Technology (ICT) involves the process, production, storage, use, sharing and spreading of

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information. The fact that there is a necessity to review and change the methods and teaching programmes used for these skills [3] makes the use of ICT and cognitive tools based on computers, important in education. When we speak of the tools of ICT used in education the first things that come to our minds are computers.

CAI is the method of utilising computers with the aim of enabling a student to understand his or her deficiencies and strengths in the process of education, to take control of his or her learning by receiving feedback, and to make him or her more interested in lessons by means of graphs, voices, figures and animations [2]. Computers, which can be used in all fields of education, are also relevant in the field of mathematics [4-6].

According to Baki [2], mathematics teaching that is performed by the use of computer-based cognitive tools is called Computer Assisted Mathematics Instruction. Different types of computer software have been developed for use in CAI environments. One of these is "GeoGebra" which is a type of dynamic mathematics software [7]. GeoGebra contains the features of different types of software, such as Dynamic Geometry Software (DGS), Computer Algebra Systems (CAS) and spread sheets, thereby combining arithmetic, geometry and algebra in a single package [8-10]. GeoGebra is important because it allows students to visualise various fields of mathematics [11-13]. As a result of this, modelling, discovering and explaining the relationships between mathematical concepts is made significantly easier with GeoGebra [14-16]. The use of this software is also beneficial to processes such as preparing activities and materials for mathematics lessons [17-19].

The topic of line graphs requires a high level of conceptual understanding, which includes: (1) understanding definitions and formulas, (2) differentiating the concepts of coordinates (x and y), and slope, which are the basic elements of a line equation, as well as (3) the ability to interpret graphs by applying algebraic equations and determining a line equation by analysing graphs [20]. After examining the literature, it was observed that students had various learning difficulties and misconceptions regarding the topic of "Linear equations and graphs" [21-24]. Given this knowledge, it is important to use instructional methods to overcome the present difficulties impeding learning of these topics. One instruction method that may help to overcome these difficulties is the CAI method. A number of studies report the results of teaching the topic of "Linear equations and graphs" by means of the CAI method. Birgin, Kutluca and Gürbüz [25], examined the successful effect of a CAI method in teaching the concepts in the topic, "The coordinates of a point on plane and line graphs", for a seventh grade class. The results indicated that the CAI method was more effective in increasing student success when they compared it with the conventional instructional method. Another study was carried out by Türkdoğan [24] on the topic of "equations and graphs" with a class of prospective teachers. The study focused on the learning outcomes that emerged while the prospective teachers were participating in computer assisted mathematics instruction activities. According to the results obtained by the study, a learning environment that allowed for students' active participation in activities was created by means of computer assisted mathematics instruction, and students had the opportunity

to engage with many different concepts. Determination of misconceptions, and the means of overcoming them, was provided by means of the materials that were used in these environments. A different study carried out by Erek [22] investigated the misconceptions of elementary school students regarding equations and examined the role that technology can play in overcoming these misconceptions. Analysis of the data determined that technology had a positive effect on preventing and overcoming misconceptions. Öner [26] examined the effect of a technology-assisted instructional method on the attitude of students while teaching the topic of equations, and also analysed the success and permanence of learning. He concluded that the technology-assisted instructional method increased the level of success of students in the topic of equations. He also found that there was no effect of the method on permanence of students' knowledge. A study carried out by Magidson [27] explored the effect of technological environments during the teaching of linear equations that had been prepared from a constructivist understanding. It was concluded that the computer software used in mathematics lessons helped students to understand the relationship between algebra and graph images of linear equations.

This study has significance regarding the enrichment of learning environments with CAI methods and developing and implementing the materials of CAI methods in teaching the topic of "Linear equations and graphs", which is included in the seventh grade programme of elementary schools. The aim of this study was to examine the effect of CAI methods on the academic success of students in teaching of the topic, and also to determine the views of students regarding the use of GeoGebra in the teaching and learning of mathematics.

2. Method

In this study, a mixed methods design was used. A mixed methods design allows support for the problem of the research, both in quantitative and qualitative terms, without restricting data collection with the prototype method [28]. Triangulation, which is a type of mixed method, was chosen as the study design. According to McMillan and Schumacher [28], this design makes study data more comprehensive by compensating for the weak aspects of qualitative and quantitative methods. In this design, in which quantitative and qualitative data are collected simultaneously, whether or not the data support each other is taken into consideration. The quantitative data of the study was obtained by using a quasi-experimental method, while the qualitative data of the study was obtained using a case study [29].

2.1. Participants

The sample for the study consisted of 57 students, in two different seventh grade classes of an elementary school in Erzurum. One of the classes was chosen as the treatment group in which a CAI method was used (N=29); and the other class was chosen as the comparison group in which a conventional instructional method was used (N= 28). This designation was carried out randomly.

2.2. Data collection tools

The quantitative data of this study was obtained using a linear equations and graphs knowledge test (T_1; Appendix 1) and the mathematics grades of students from the previous semester (T_2). The knowledge test was prepared by considering the sub-learning fields, learning outcomes (explain linear equations, explain and use the Cartesian coordinate system, draw graphs of linear equations) for the topic of "Linear Equations and Graphs" and the content of the 7th grade mathematics textbooks [30-34]. The content validity of the knowledge test, which consisted of 14 questions, was performed by taking into consideration the opinions of three mathematics teachers, three post graduate students and four instructors. The test, which measured learning outcomes, was taken by 103 students and its reliability was tested. The Kuder–Richardson-20 (KR20) reliability co-efficient of the test was calculated to be 0.904.

In the study, qualitative data were obtained from an open-ended questionnaire (T_3) and from focus group discussions (T_4). The following questions in the open-ended questionnaire aimed to determine how a CAI method, GeoGebra, affected the perceptions of students towards the mathematics lessons:

- What do you think about the application that was carried out?
- What do you like about the application that was carried out?
- What do you dislike about the application that was carried out?
- What difficulties did you encounter in carrying out the application?

2.3. Application

The experimental method of the study is summarised in Table 1.

Table 1: The design of the study

Group	Pre-Test	Application	Post-Test
Treatment	T_1,T_2	Computer Assisted Instruction	T_1, T_3, T_4
Comparison	T_1,T_2	Traditional teaching	T_1

The first author taught the lessons to both the treatment and comparison groups for a period of 9 hours of course time based on the curriculum.

In the comparison group, lessons were taught using a conventional instructional method, where the lessons were teacher-centred, where the teacher used, in general, direct instructional methods and question-and-answer techniques. The only materials used were a chalkboard and course books. Two examples of lesson activities with the comparison group are as follows:

Sample application 1: An activity conducted in parallel with the learning outcomes of "explaining linear equations" within the subject Linear Equations and Graphs:
The production of 1 kg of dried grapes requires 5 kilograms of fresh grapes. Accordingly, please explain the relationship between the fresh and dried grapes, using your own words, in Table 2, by filling in the gaps. Then, with the help of Table 2, find the equation that shows the relationship.

Table 2: Relationship between fresh grapes and dried grapes

Dried grapes (kg)	The required fresh grapes (kg)	Relationship
1	5	……
2	..	
3	..	
4	..	
A	..	

Find the answer to the question "what weight of fresh grapes should be dried to gain 6 kg of dried grapes". Find the answer to this question with the help of the equation, and compare the results.

Sample application 2: An activity conducted in parallel with the learning outcomes of "drawing graphs of linear equations" within the subject Linear Equations and Graphs: *Find the values of variable the y by assigning different integer values to variable x in the equation y= -3x+1; find the ordered pairs corresponding to these values (as in the example in Table 3).*

Table 3: Forming ordered pairs for an equation

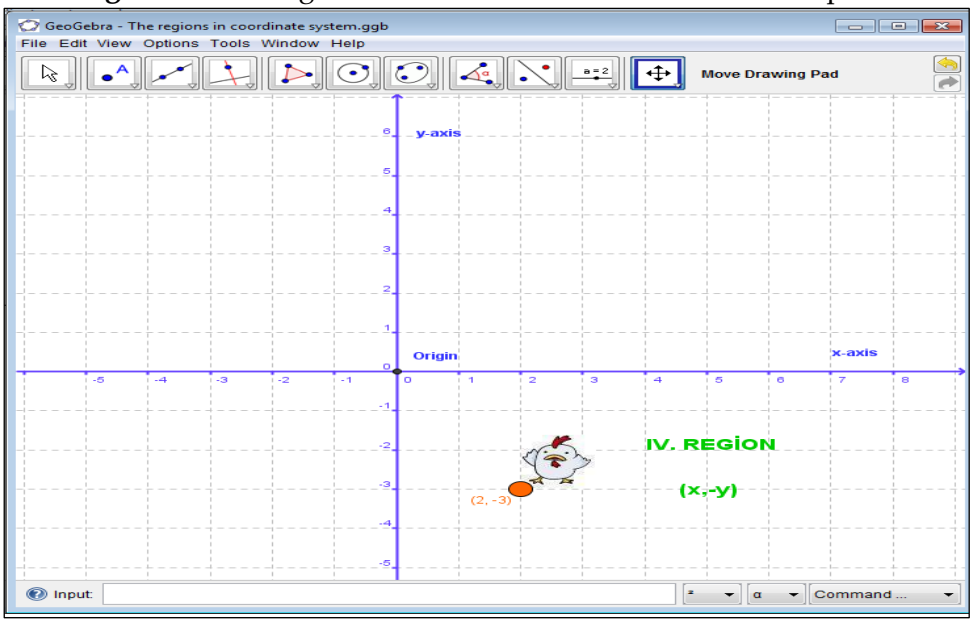
x	-3x+1	y	(x, y)
1	-2	-2	(1, -2)
…	…	…	…
…	…	…	…
…	…	…	…

Mark the points that correspond to the ordered pairs in the coordinate system. Determine the graph of the equation by combining the marked points.

In the treatment group an introductory 1 hour of course time was devoted to a seminar to explain to the students the GeoGebra software and its materials. This was followed by the use of its application by the students. In the application, lessons were taught by means of materials and worksheets that had been previously prepared. Three of the 23 GeoGebra materials that were prepared in parallel with the learning outcomes of the topic on Linear Equations and Graphs are discussed below.

Sample application 1: An image of the GeoGebra material to write the coordinates of a point correctly is presented in Figure 1. This material was prepared as part of the learning outcomes of "explaining and using the Cartesian coordinate system" within the subject Linear Equations and Graphs.

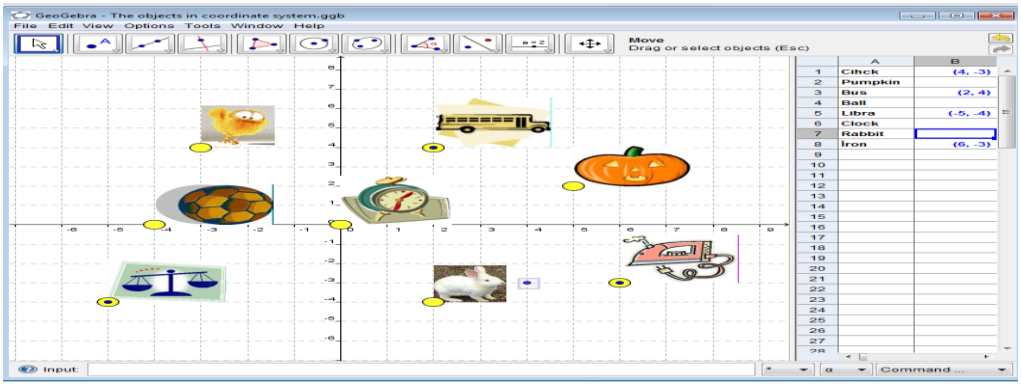
Figure 1: An image of the material of the coordinates of a point



Students were asked to record the points, as ordered pairs, where objects are located on the coordinate system into the spread sheet next to their names and push the enter button. Next, they had to decide whether or not the point recorded is the correct one by using the materials provided.

Sample application 2: An image of the GeoGebra material which was prepared for the students to answer the following question about the notation of abscissa and ordinate of a point is presented in Figure 2. This material was prepared to meet the learning outcomes of "explaining and using the Cartesian coordinate system" within the subject Linear Equations and Graphs.

Figure 2: An image of regions material in the coordinate system

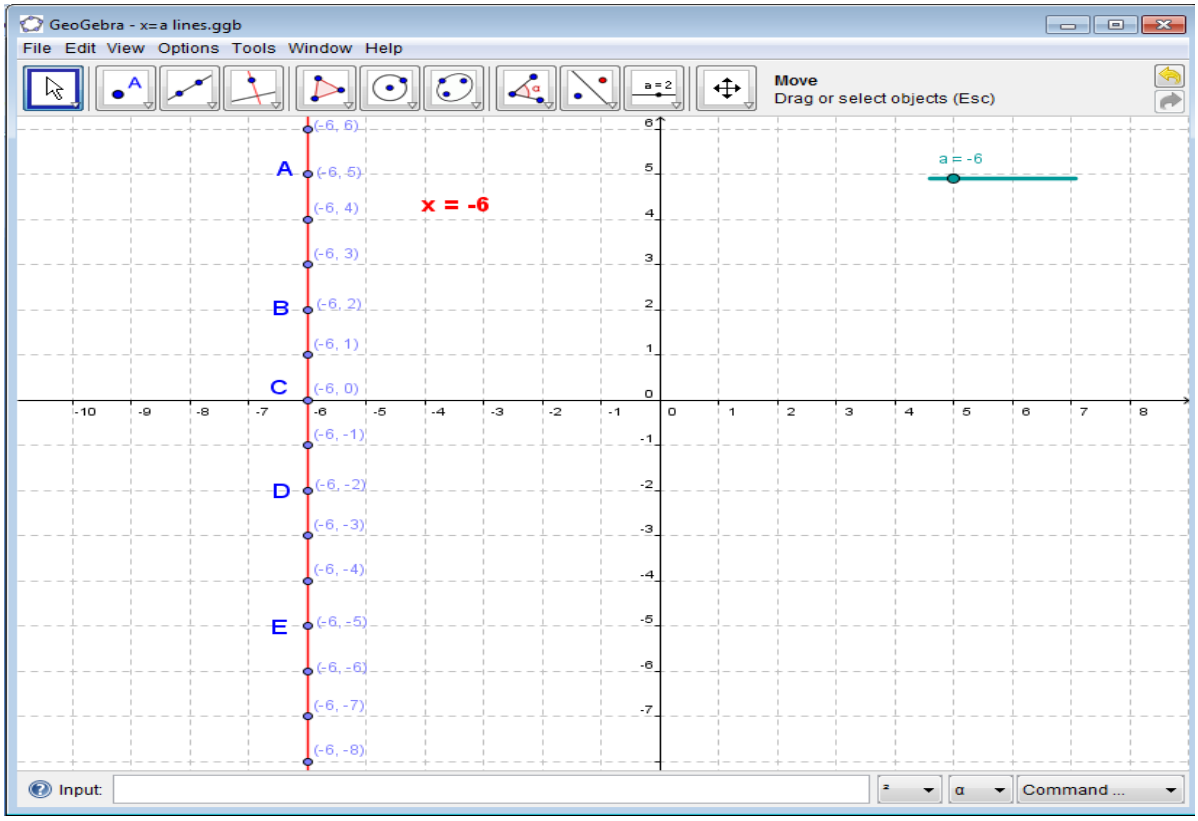


Can you make a generalisation regarding the notation of abscissa and ordinate of a point located in the first, second, third and fourth region in the coordinate system?
Students were asked to select the chicken by using the mouse on their computers and moving it towards different points in order to reach the desired general information regarding the notation of the abscissa and ordinate in the region where the point is located. Students were also asked to

note the points where the chicken is located on the worksheets and then come to a general decision.

Sample application 3: An image of the GeoGebra material that was prepared with a view to find the name of the line that was indicated by the set of points whose abscissas were the same is presented in Figure 3. This material was prepared in parallel with the learning outcomes of "drawing graphs of linear equations" within the subject Linear Equations and Graphs.

Figure 3: An image of the material of the set of points whose abscissas are the same



The students were asked to move the slider on the desired values in the worksheets and create a set of points that have the same abscissas. Students were also asked to record the coordinates of some of the points (for example A, B, C, D and E) that have the same abscissas for any value of the slider on the worksheets, to examine these points and then make a general conclusion.

2.4. Data analysis

Each correct answer in the linear equations and graphs knowledge test was scored 1 point. However, 0 point was assigned to an incorrect response or unanswered question. The test consisted of a total of 44 questions and subquestions.

For the analysis of the quantitative data and to determine whether or not there was a difference between the groups, an independent samples t-test was performed by

means of the SPSS 16.0 package programme. The significance level was set to 0.05, since it is the most commonly used value in educational studies.

A descriptive analysis was used for the qualitative data that were collected to determine the views of students regarding the use of GeoGebra in the teaching of the mathematics content. For this analysis process, the questions raised with the students in the treatment group were coded from S1 to S26.

3. Results

The analysis, which was made before commencing with the application, indicated that at the beginning of the study there was no significant difference between the mathematics semester grades of the students in the treatment and comparison groups ($t=0.29$; $p=0.977$).

The results of the analysis of the pre-test scores of the students for the topic of linear equations and graphs in the treatment and the comparison groups are presented in Table 4. No statistically significant difference ($t= 1.609$; $p>0.05$) was found between the success scores of the groups (see Table 4). As a result, it can be seen that both groups have a homogenous structure.

Table 4: The pre-test success scores of the topic of linear equation and graphs

Group	N	Mean	SD	t	p
Treatment	29	8.69	1.702	-1.609	0.113
Comparison	28	11.43	1.711		

The maximum score for this test is 44. The results of analysis regarding the post-test success scores of the students for the topic of linear equations and graphs in the treatment and the comparison group are presented in Table 5.

Table 5: The post-test success scores of the topic of linear equations and graphs

Group	N	Mean	SD	t	p
Treatment	29	26.48	2.388	2.386	0.021
Comparison	28	20.79	2.394		

The maximum score for this test is 44. As can be seen in Table 5, there is a statistically significant difference between the scores of the groups ($t= 2.386$; $p<0.05$). According to the results of the analysis, the success of the students in the treatment group for the topic of linear equations and graphs is higher than that of the students in the comparison group. This result indicates that CAI positively contributes to success when compared to conventional instruction.

Table 6 shows the distribution of the number of students who gave correct answers to the information test according to participant groups.

Table 6: Distribution of the students who gave correct answers to the information test

Question numbers	Treatment group		Comparison group	
	Pre-test	Post-test	Pre-test	Post-test
1.	11	21	5	10
2.	2	11	0	3
3.a	9	20	8	6
3.b	10	23	8	17
3.c	9	20	5	7
4.a	13	20	11	20
4.b	15	26	12	20
4.c	19	27	16	23
4.d	17	25	15	21
4.e	21	28	20	28
4.f	18	27	15	21
5.	0	4	0	0
6.a	16	17	13	20
6.b	12	25	12	18
6.c	15	26	14	20
6.d	10	24	15	16
7.a	5	13	3	14
7.b	3	19	8	16
7.c	5	16	2	14
7.d	3	22	9	18
8.a	5	21	4	13
8.b	4	20	3	9
8.c	6	21	7	10
9.a	2	18	9	13
9.b	2	18	7	14
9.c	1	14	7	14
9.d	1	17	6	12
9.e	1	23	8	14
9.f	0	21	6	12
9.g	1	8	4	4
10.	2	13	7	9
11.a	0	15	3	11
11.b	0	14	3	9
11.c	0	1	0	2
11.d	1	4	0	1
12.a	2	12	5	14
12.b	2	18	6	16
12.c	2	22	10	19
12.d	1	20	8	19
12.e	1	14	7	15
12.f	3	18	7	15
13.	1	8	6	9
14.a	1	8	3	9
14.b	0	6	3	7

Treatment group (N=29), comparison group (N=28).

The treatment group gave more correct answers than the comparison group, demonstrating that the CAI method is more useful than the traditional teaching method for developing skills in linear equations and graphs.

The qualitative data were collected by taking as the basis the study question "What are the views of students regarding the use of GeoGebra in the teaching and learning of mathematics?" An open ended questionnaire and focus group discussions were used. The findings and interpretations obtained from this qualitative data are presented below. The categories that were prominent in the perceptions of students regarding the use of GeoGebra were examined under two headings as positive views and negative views.

The answers given by students were analysed and presented in Table 7 as codes.

Table 7: The views of students about computer assisted instruction

Categories	Codes	Frequencies
Positive views	lessons are better and more enjoyable	19
	the topic is understood better	14
	the positive effect of the use of computer in the lesson	11
	the positive effect of the worksheets in the lesson	8
	a mathematics lesson is understood best with a computer	7
	the lessons are better visualised by means of computers	7
	the topic is animated in the mind	5
	receiving feedback by means of the worksheets	4
	the teacher provides guidance to students in the lessons	3
	the GeoGebra software used is liked	3
	the slider provides dynamism	3
	students develop positive attitude towards mathematics	2
	concepts are learned better by means of a computer	2
	the lessons are more fluent	1
	students concentrate on lessons better by means of the application	1
	concepts are learned by carrying out tests on a computer	1
	it increases the interest and attention in the lesson	1
	the information is more permanent	1
	it provides active participation in the lesson	1
	it provides learning without memorisation	1
Negative views	students have difficulty in filling in the worksheets	6
	students have difficulty in learning the topic of equations	5
	the difficulties faced when using a computer	4
	students have difficulty using the slider	4
	students who cannot use a computer well enough fall behind in the lesson	2
	students have difficulty finding the coordinates of the points except for integers	1

The data obtained from the open-ended questionnaire and focus group discussions indicated that students had different views regarding the application.

The topic was stated to be better understood through the applications of the CAI method by nineteen students. The statement of one of these students (S9) is as follows:

"*As for me, the fact that the computer had images and a sparkly monitor was the most enjoyable part of the application. In addition, the worksheets also provided better understanding of the topic*."

We can change the location of objects by means of the slider, which is an important feature of GeoGebra. This provides students with opportunities to solve problems by examining mathematical relationships in a dynamic structure. S3, who is among the 3 students who stated that the use of the feature of slider was beneficial, expressed the following:

"We had been able to observe a lot of circumstances on the material simultaneously by means of the slider."

S26, who is among the 2 students who expressed the opinion that they developed a positive attitude towards mathematics by means of the CAI method, stated his/her opinion as follows:

"I was scared when I saw a mathematics question and I had difficulty in solving that problem. From now on I will not be scared of mathematics."

S25, who is among the 7 students who stated that they understood the mathematics lesson best when using a computer, expressed his/her opinion as follows:

"*In my opinion, this application was very good. I have never understood mathematics better than this*."

With the rapid development of technology today, a new generation of students uses technological devices, such as computers, with great interest. In this respect, carrying out lessons in computer environments, which can increase the interest of students who are familiar with computers, can affect their academic success in a positive way. S13, who is among the 14 students who stated that the topic was understood better by means of GeoGebra, expressed his/her opinion as follows:

"*I understand the lesson better with the application implemented and I concentrate on the lesson better*."

Carrying out activities that can draw the attention of students in education might allow them to be more active in the lessons and might provide them with more permanent information.

The opinions of some of the students, among the 7 students, who stated that concepts were better visualised by means of a computer are as follows:

"*Since the lessons were applied through a computer and visuals, I understood the lessons better. As a result, I really liked the application.*" (S21)

"*I can say plenty of good things regarding the application I used. The lessons were more fluent and enjoyable; I really understand coordinate systems very well now*." (S3)

The opinions of some of the students regarding the positive effect of worksheets used in the application in order for them to realise the relationship between features and concepts that should be learned are as follows:

"*The feedback we received through worksheets increased our interest in the lesson*." (S26)

"*We were able to see our deficiencies by means of the feedback we received through worksheets*." (S14)

"Filling in worksheets provided us with permanent information." (S6)

4. Discussion and Suggestions

The fact that there is a statistically significant difference between post-test success scores of the students in favour of the treatment group indicates that the CAI method provided a more positive contribution to success when compared to conventional instruction. This result supports the conclusion of the study carried out by Birgin et al. [25] with a view to examine the effect of the CAI method in teaching the concepts in the topic of "The Coordinates of a Point in Plane and Line Graphs" on student success. Similarly, by Aktümen and Kaçar [33] in teaching operations by means of expressions with letters at the 8th grade elementary school level, by Hitt [4] on mathematical proving processes, by Kepceoğlu [16] on teaching limit and continuity, by Ross and Bruce [5] on teaching fractions, by Samkova [6] on teaching analysis lesson, by Selçik and Bilgici [34] on teaching polygons with a view to determine the efficiency of the CAI method, all concluded that a CAI method is an effective method in increasing student success.

The results showed that 31% of the students surveyed indicated that the feedback they received in the CAI environments, together with worksheets, increased their interest in the lessons, and they reported that filling in the worksheets provided them with permanency of information. This result paralleled the results of studies carried out by Ubuz, Üstün and Erbaş, [35], Gökcül, [36], Muller, Buteau, Klincsik, Perjesi-Hamori, and Sarvari, [37]. Furthermore, Coştu and Ünal [38] concluded that worksheets were important in terms of achieving permanency of information. Some students (65%) expressed the opinion that they liked this software and the instruction method that used it. They also stated that they understood the lessons better and that the lessons became more enjoyable through this method. The reason behind this finding might be the interest exhibited by students in developing technology. It is considered that the students' interest in technology contributes both to their motivation in the

lessons carried out via the CAI method and to their success. In a study carried out by Aktümen and Kaçar [33], the views of students regarding CAI were examined, and it was observed that CAI increased the motivation of students. For example, 24% of the students stated that the topics were better visualised by means of the CAI method. When the results of all the studies were examined, it is indicated that visualising concepts by means of types of software integrated in at CAI method is important in teaching mathematics [9, 12, 14, 42, 43].

In our study GeoGebra software was used for the topic of "Linear Equations and Graphs" and the effect of this software on students was tested. It was observed that students learned much more easily through discovering and completing exercises in the dynamic environment of CAI while drawing the graph of the line requested or finding the coordinates of the given point. According to our study, we concluded that the students in the treatment group were more successful in the lesson when the CAI method was implemented. We recommend that similar studies should be carried out in the teaching and learning of other mathematical concepts. Furthermore, different teaching methods should be used by taking into consideration the individual differences of students. As in all teaching methods, the CAI methods have certain limitations. Previous studies reported that students faced some problems when technology was used [40-44]. According to Yenilmez and Karakuş [44], the use of computers in education, as in many other fields, limits students' socialization. Students' proficiency in the use of many types of mathematical software is also an important challenge. Dikovic [43] found that students with no experience of software have great difficulty in using the commands in the algebra bar. Students had difficulty learning basic commands despite their simplicity. In addition, Dikovic [43] observed that methodological approaches such as experimenting with variables and observing the resulting changes were not easy for every student [42]. Artigue [41] noted that various studies reported on the complexity of using lesson tools and equipment. In addition, there is a necessity to become familiar with teaching tools to convey mathematical content to students introduces significant complexity and cost when new technologies are adopted [42]. In our study we found that the use of the CAI method was not interesting for a few students who did not like to use computers or who had a negative attitude towards computers. This situation can be considered as a limitation of the CAI method.

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Appendix 1: Linear equations and graphs knowledge test (T_1)

Month	**0.**	**1.**	**2.**	**3.**	**4.**
Length(m)	1	2	3	4	5

1. Bekir buys a creeper and he measures the length of the creeper for 4 months.
Is there a linear relationship between the length of the creeper and month, according to the table? Please, write the equation of this relationship.

2. Considering the table below is formed for the line equation of y = x - 1, what is the sum of a + b + c?

x	**0**	**a**	**3**	**5**	**c**
y	-1	-2	b	4	0

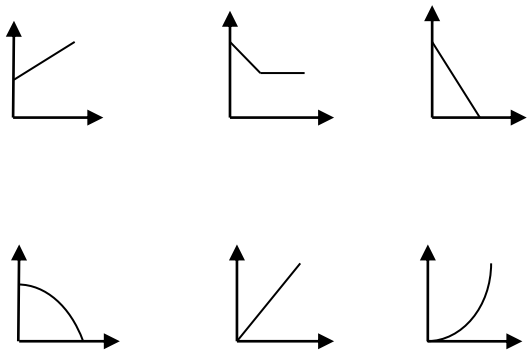
3. Mr. Serkan takes a bus to and from work. The number of the tickets that Mr. Serkan buys according to the number of days is shown in the table.

Days	**1**	**2**	**3**	**4**	**5**	**...**	**n**
Tickets	2	4	6	8	10	...	...

Accordingly;

1. Fill in the blanks in the table and write the algebraic expression that corresponds to the table.
2. Is there a linear relationship in this expression? Why?
3. Find the number of tickets that Mr. Serkan would buy for 30 days.

4. Investigate the graphs below. Write the appropriate expression, "linear" or "not linear", in the blank below the graphs. Additionally, state the reason for your choice.



5. Considering the 2x-y-a=0 line intersects the point of A (2,-4), what is the value of a?

6. Write the appropriate expression, "linear" or "not linear" under the following tables. Additionally, state the reason for your choice.

x	**0**	**3**	**5**	**6**
y	1	7	11	12

x	**1**	**2**	**3**	**4**
y	60	120	180	240

x	**4**	**6**	**8**	**10**
y	1	3	5	7

x	**1**	**2**	**3**	**4**
y	8	12	10	6

7. Write the appropriate expression, "linear" or "not linear", beneath the following equations. Additionally, state the reason for your choice.
2x+y+5=0 y=0 y=3x-4 x=4

8. A motor company sells 25 vehicles each month,

1. Draw a table that shows the relationship between the number of vehicles sold and the number of months.
2. Determine whether this relationship is linear or non-linear, and write the appropriate equation.
3. Find that how many months should pass to sell 75 vehicles.

9. Draw a coordinate system, show the ordered pairs below, and determine their region.

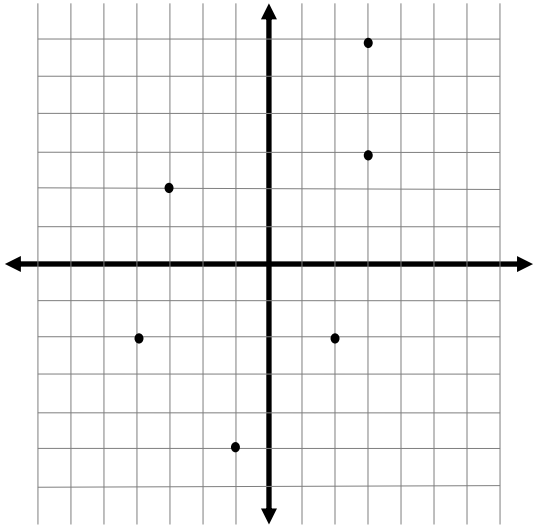
a) (2, 0)
b) (4, -5)
c) (0, -8)
d) (3, 5)
e) (0, 0)
f) $(\frac{3}{2}, \frac{1}{2})$,
g) (2, 1)

10. Hatice claims that the ordered pairs of (1,5) and (5,1) shows the same point, and Fatih says that this is not true. Who is correct? Why?

11. Draw the graphs of the equations that are written below;

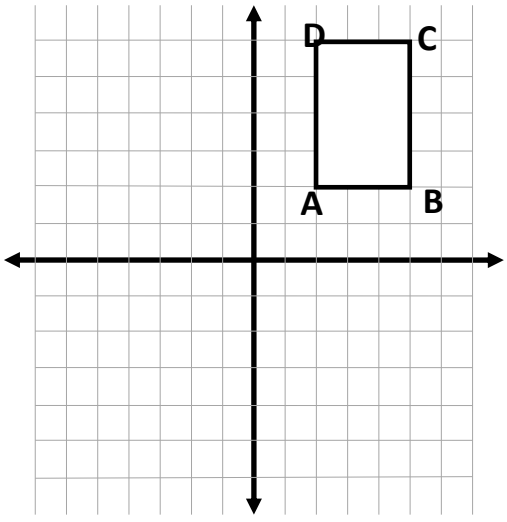
y=4 x=-2 y=-2x+4 2x+y+3=0

12. Name the points below according to the given clues.

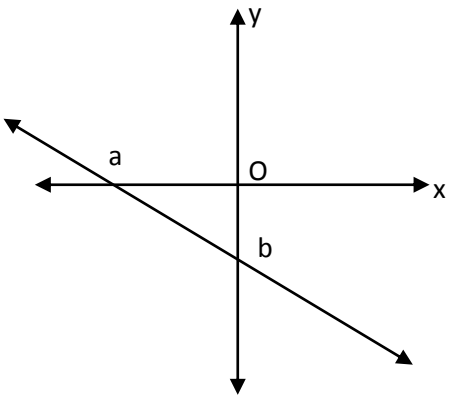


- The abscissa of point A is inverse of its ordinate according to addition.
- The abscissa of point B is equal to its ordinate.
- The abscissa of the point C is -3.
- The ordinate of point D is 6.
- The abscissa of point E is two times more than its ordinate.
- The ordinate of point F is 5 times more than its abscissa.

13. How many units is the circumference of ABCD quadrilateral?



14. What are the values of a and b in the graph below, where the line is described by the equation x+3y=-3?


y
a
O
x
b