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Constructivist Approach Vs Expository Teaching: Exponential Functions

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ABSTRACT: *Aim of the current research is to investigate the effect of expository teaching and constructive approach on the students' understanding the exponential functions. There were 26 students in the class where the expository teaching was conducted and 24 students in the class where the constructive approach was conducted. At the end of the treatment period, an open-ended test was conducted. The findings have been analyzed using descriptive method.When looked at the results generally, the both group have failed in terms of writing domain and range of a basic exponential function; solving an inequality consisting of basic exponential functions; reading an exponential function graphic; knowing whether an exponential function was 1-1 and onto function.*
KEY WORDS: *Constructivist learning, expository learning, exponential functions.*

I. Introduction

According to Glaserfeld (1989b), constructivism is a theory of knowledge with roots in philosophy, psychology, and cybernetics. It contains two main principles: knowledge is not passively received but actively built up by the cognizing subject and the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality.Constructivism is about helping the learner construct a viable model, and the guidance is based on the individual learner's currently existing cognitive structures (Parker and Becker, 2005).Knowledge is not attained but constructed (von Glasersfeld, 1989a).

Traditional epistemology views knowledge as an objective phenomenon while the constructivist views knowledge as a subjective understanding of the person. There are three fundamental differences between constructivist teaching and other teachings. Firstly, learning is an active constructive process rather than the process of knowledge acquisition. Secondly, teaching is supporting the learner's constructive processing of understanding rather than delivering the information to the learner. Thirdly, teaching is a learning-teaching concept rather than a teaching-learning concept (Kim, 2005).

The instructional strategy of constructivist teaching is inviting ideas, exploring, proposing explanations and solution, and taking action (Yager, 1991). According to Brook & Brooks (1993) the principles of constructivist teaching are: 1) posing problems of emerging relevance to students; 2) structuring learning around primary concepts: the quest for essence; 3) seeking and valuing student's points of view; 4) adapting the curriculum to address students' suppositions; and 5) assessing student learning in the context of teaching.

In a constructivist-driven classroom, the teacher provides opportunities for students to investigate and debate. On the other hand, the expository approach to learning refers to the transmission of information from expert to novice (Ormrod, 2005). In expository instruction the teacher is the source and the owner of knowledge (Martin, 2003). Instructors using expository methods dominate the presentation of lessons and use strategies that include lectures, demonstrations, and videos (de Jong, van Jooligen, Swaak, Veermans, Limbach, King, and Gureghian, 1998).

However, research also indicates that although students gain meaningful learning when presented material in a constructivist format, they may encounter difficulty with this method, specifically in regulating their own learning process (Charney, Reder and Kusbit, 1990; de Jong, et al. 1998; Veermans, de Jong, and Joolingen, 2000; Winter, Lemons, Bookman, and Hoese, 2001). That is, the students are required to plan and monitor their activities at a more sophisticated level than required for the more traditional expository approach. In essence, students may need better metacognitive skills in order to gain the desired outcomes from a lesson designed with the constructivist approach.

Flavell (1979) described metacognition as the concept of knowing about knowing. Metacognition is a term that refers to not only one's knowledge, but also one's ability to monitor, control and regulate the learning process (Akama and Yamauchi, 2004; Swanson, Hoskyn, and Lee, 1999; Tobias, Everson, and Laitusis, 1999). It is clear that learning about the basic mechanisms of an individuals' metacognitive behaviour will lead to the creation of methods to help improve the learning process (Tobias and Everson, 1997). Furthermore, if students are gathering meaningful information through discovery learning, yet are still encountering problems, it seems important to evaluate the execution of this monitoring process.

Instructional design based on constructivism is generally contrasted with instruction based on behaviourism, which is typically described as a rigid procedural approach, aimed at using fixed stimuli and reinforcements to promote a fixed world of objective knowledge, measured primarily in terms of observable behaviour (Skinner 1974; Caprio 1994). Instructional design based on behaviourism focuses on discrete and compartmentalized knowledge and skills rather than integration of knowledge, and conceptual understanding. The key difference between these two approaches is that behaviourism is centredaround transmission of knowledge from the instructor to the student (passive student and a top-down or instructor-centred approach) whereas constructivism is focused on the construction of knowledge by the student (active student and a bottom-up or student-centred approach).

II. METHOD

Aim of the current research is to investigate the effect of expository teaching and constructive approach on the students' understanding the exponential functions. The participants of the research weretwo tenth grade students. As the students of this school were selected according to the results of a national exam, it is known that the mathematical abilities of students in both classes were high and equal averagely. There were 26 students in the class where the expository teaching was conductedand 24 students in the class where the constructive approach was conducted. This study is a qualitative research. At the end of the treatment period, an open-ended test was conducted. The findings have been analyzed using descriptive method.

The treatment period was 4 hours over one week. The constructivist teaching approach based on Yager(1991) undertook the following steps: 1) inviting ideas; 2) exploring; 3) proposing; 4) explanation and solution; 5) taking action. Expository teaching approach undertook the following steps: 1) introduction; 2) development; 3) review.

III. FINDINGS

Findings Regarding Question 1

What is the domain and range of the function $(x) = a^x$?

Table 1. Frequency Table Related To Question 1

	a		x		y	
	C.G.	E.G.	C.G	E.G.	C.G	E.G.
R	4	3	12	10	6	7
$R^+ - \{1\}$	5	10		1		2
R^+	3	3	4	6	9	9
$c > 1$	1	2				
$R - \{0\}$		1		1		
$R - \{1\}$	1				1	
$R^+ - \{0\}$				1		1
Z^+	1	1	1	2	1	
$\mathbb{C}$	1		1			
Unanswered	9	6	7	5	8	7

As known, the answer of this question is $a \in R^+ - \{1\}, x \in R, y \in R^+$. When analyzed the Table 1; it was determined that the rates of correct answers of the students in the constructive group to a, x and y were 20%, 48% and 36% respectively. On the other hand, it was seen that the same rates in the expository groupwere 38%, 38% and 35% respectively. When analysed the wrong answers in the both groups; it was seen that the answers of R and $R^+$for a, $R^+$for x and R for y were given commonly.

Findings Regarding Question 2

$a)\ 5^x \leq 7^x\ b)\ \left(\frac{2}{3}\right)^x > \left(\frac{1}{2}\right)^x$ Find the solution sets.

Table 2. Frequency Table Related To Question 2

	a		b	
	C.G	E.G.	C.G	E.G.
x≥0	14	11	1	
x>0	2	5	5	9
N		2		
R		2		1
[0,1)		1		1
x≥1			7	2
N^+				1
Ø				1
x>1				3
R-{0}			2	

z^-				1
Unanswered	9	5	9	7

The answer of this question is x≥0 and x>0 respectively. When examined the Table 2; it was determined that the rates of correct answers of the students in the constructive group to the choices a and b were 58% and 21% respectively. On the other hand, it was seen that the same rates in the expository group were 42% and 35% respectively. Besides, the students exhibited lower success rates for the choice b. However, it was seen that the almost all the students could not present any solution for this question.

Findings Regarding Question 3

Order the numbers a, b, c and d.

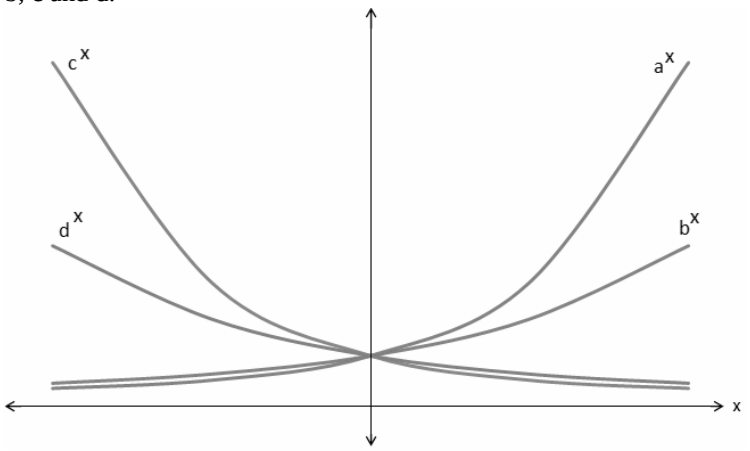

Table 3. Frequency Table Related To Question 3

	a>b>c>d	a>b>d>c	c>d>a>b	a>b>,c>d	a=b>c=d	a=c>b=d	b>d>a>c	Unanswered
C. G.	8	8		1	1		1	5
E. G.	5	16	3	1		1		

The answer of this question is a>b>d>c .When looked at the Table 3; it was seen that the rates of correct answers of the students in the constructiveand expositorygroup was 33% and 62% respectively. It was seen that the almost all the students could not present any solution for this question. However, a few students made explanationslike "for the $a^x$and $b^x$is an increasingfunction a>b, for the c^x and d^x is a decreasing function d>c".

Findings Regarding Question 4

Is an exponential function 1-1 and onto function?

Table 4. Frequency Table Related To Question 4

	1-1 because		Ontobecause	
	E.G.	C.G.	E.G.	C.G.
Every element has an image	14	8	3	5
There is a (only one) x value for the every y value	3		9	2
Different elements have different images	1	1		
Exponential functions have invertible	2		2	

However, 2 students in C.G. and 1 student in E.G. stated that an exponential function was not 1-1 and 3 students in C.G. and 2 students in E.G. stated that an exponential function was not onto as there was not any element in the domain corresponding negative real numbers or zero in the range. The explanations made were generally on the basis of numeric values by considering the function of $f(x)=2^x$. Besides, it was expressed that there was a corresponding element of each element by drawing a typical graphic.

IV. Discussion And Conclusion

When looked at the results generally, the both group have failed in terms of writing domain and range of a basic exponential function; solving an inequality consisting of basic exponential functions; reading anexponential function graphic; knowing whether an exponential function was 1-1 and onto function. Besides, when looked at the papers, it can be stated that almost all of the students couldn't write a mathematical solution. The students were expected to be able to use function concept for exponential function while constructing their knowledge but the result showed that this expectation was not realized.

As the students in Turkey are educated test oriented, it is known that conceptual learning is so low. When viewed from this aspect, the students' success rates regarding conceptual questions about exponential functions was considerably low. In this situation, if the students prefer instrumental learning to conceptual learning, it can be said that teaching aimed conceptual learning has no effect on conceptual learning.

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