



Perception of Visually Impaired Students Equal Sign and Equality

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Abstract

The Through the development of the science education, enhancing training quality of students become important and teachers started to use different methods to improve students' logical reasoning, scientific operations skills such as problem solving. So that problem solving which has an important role in improving logical responding and critical thinking [1], become in the center of the research in order to obtain efficient results in students' achievement.

In this point, the researcher is focused on understanding and using problem solving process which depends on understanding a number of some basic concepts such as the concept of equality. From the first year of the elementary education the students use the equal sign to show the equality between the equations and the results of the calculations especially in algebra courses. In other words, the equal sign is used for give the result of a problem or the calculations. After teaching of the other subjects in algebra such as identity, they learn different usage of the equal sign. As a result one of these important misconceptions occurs in students about equal sign is that perceiving the sign as an action [2]. Moreover studies showed that students have difficulties in learning the equal sign [3, 4]. As the nature of the mathematics, in particularly algebra, also visually impaired students encounter difficulties in learning the subject.

When it is examined the visually impaired students using mathematics while problem solving in science, it can be seen that these student acquire any concept of number in a slow way as the mathematics concepts being abstract. [5] claimed that it is difficult for visually impaired students to understand the concepts concretely since they are lack of the opportunities to see equations or equal sign. As a result of this, it leads to difficulties to handle simple operations. To overcome these difficulties Braille Code can be used. However, [6] found that students can confuse easily with the pattern of dots so usage of Braille Codes cannot be the solution for teaching these concepts. In this paper, it is aimed to determine that how students perceive the equal sign and equality concept. More fundamentally, study is designed to seek the visually impaired students' ways of understanding the equal sign and the concepts associate with the equal sign and the equality.

In this study, visually impaired students will be depth interviewed. Students will be allowed to participated the study voluntarily. The study will be conducted with each student individually. The interviews will be recorded to analyze in detail. In this process, they will not asked to their names, only their background information. It will asked in the interviews in order to determine how students perceive the equal sign and equality. As the study is in progress, from the experience of the researchers past experience expected outcome of the study is that the visually impaired students may perceive the equal sign as "a symbol" rather than a relational symbol or operational symbol. Moreover they may not perceive the meaning of the equality and cannot relate with the other concepts or the context in which the equation sign is used. The reason of such outcome would be said the techniques used in teaching equation sign. If the right tools and instructions are provided it is possible for blind students to study and understand significant elements of problem solving process hence their critical thinking and scientific operational skills may improve.

1. Introduction

The Through the development of science, education is affected so that enhancing training quality of students and develop their scientific skills are become important issues. As it is known science



includes integration of different skills such as defining a parameter, logical responding, critical thinking or interpreting of graphics which have very close relation with mathematics. According to [8], these kinds of skills help to students to go towards problem solving to solve the problem. From this point of view to improve of students' scientific operation skills, their problems solving skills should be improved. Hence, teachers started to use different methods and researchers started to examine relationship between the students' scientific skills success and problem solving skills [9, 10]. Moreover, the researchers are focused on understanding and using problem solving process in order to explain this relationship. Some of these studies showed that students' scientific skills and their achievement are affected from problem solving skills. As problem solving skills include integration of different concepts and skills, it has also an important role in improving logical responding and critical thinking [1]. In addition to these, as both of these two concepts are compounds of the scientific skills they become in the center of the researches in order to obtain efficient results in students' achievement. When problem solving is examined in a detailed way it can be seen that it is a process to find new solutions for the given problem and also is to employ the rules which are learned before [7]. Thus, students need to know mathematics and its concepts in order to solve the confronted problem. In this point when students have limited knowledge about mathematics especially equations and equality they cannot solve the problem. It can be inferred from here to be successful in problem solving students need to solving equations and they need to understand the equality conceptually.. From the first year of the elementary education the students use the equal sign to show the equality between the equations and the results of the calculations especially in algebra courses. In other words, the equal sign is used for give the result of a problem or the calculations. After teaching of the other subjects in algebra such as identity, they learn different usage of the equal sign. As a result one of these important misconceptions occurs in students about equal sign does that perceive the sign as an action [2]. Moreover studies showed that students have difficulties in learning the equal sign [3, 4]. As the nature of the mathematics, in particularly algebra, also visually impaired students encounter difficulties in learning the subject.

When it is examined the visually impaired students using mathematics while problem solving in science, it can be seen that these student acquire any concept of number in a slow way as the mathematics concepts being abstract. [5] claimed that it is difficult for visually impaired students to understand the concepts concretely since they are lack of the opportunities to see equations or equal sign. As a result of this, it leads to difficulties to handle simple operations. To overcome these difficulties Braille Code can be used. However, [6] found that students can confuse easily with the pattern of dots so usage of Braille Codes cannot be the solution for teaching these concepts. In this paper, it is aimed to determine that how students perceive the equal sign and equality concept. More fundamentally, study is designed to seek the visually impaired students' ways of understanding the equal sign and the concepts associate with the equal sign and the equality.

2. Theoretical framework

Based on these this claim they developed concept image and concept definition model. According to this model all mathematical concepts except primitive ones have formal or non-formal definitions. This process is also tried to define by the constructivist approach [11] and by the socio- cultural approach [12]. [13] point out that in the process of learning a concept, having rich concept images is important as much as know the concept's definition.

The concept image and definition of visually impaired students was sought on the basis of the framework of concept image. Concept definition and image is first introduced by [14]. They suggest that concept definition and image is when we think of a concept something is evoked in our mind. [14] claim that individuals have different features in the scope of epistemological and psychological way so same concepts can be percept in a different way and construct their mind according to their perception and also they support this construction with their experience through time. In their study [14] states that people use mathematical concepts to define it. They explain this process as the total cognitive



structure that is associated with the concept, which includes all the mental pictures and associated properties and processes' (p. 152). In [15] in his study argues that individualistic differences and perceptions make students to construct different concept image and differences and also experience affect this process. Under the light of these, the research questions are as follows:

Which of the concept images and concept definitions do the students have about equality?

What are the reasons of forming these images or definitions rather than the intended one?

3. Methodology

In order to answer the research questions above, qualitative research method was used for this study. The data was collected using semi-structure interviews. Six visually impaired students were selected according to theoretical sampling. [16] defines theoretical sampling as "choosing the sample according to relationship between their characteristics and the research questions and in order to build in certain properties or criteria which aid developing and testing the theory. Students will be allowed to participate the study voluntarily. The study was conducted with each student individually. The students were interviewed and recorded to analyze in detail and discover the sources of unintended concept image. During the interviews particularly focused on equal sign and equality. The interviews were recorded and were transcribed. Interviews were semi-structured and included three questions. First, participants were asked to open ended contextual question and asked them to define the problem, then they were wanted to write the questions in equation form. They were also asked follow-up questions about their concept maps and open number problem is asked them and wanted to interpret the problems. In the third question they were asked the definition of equation and what does it means them. The recordings approximately took forty five minutes with each student. In this process, they were not asked to their names, only their background information. The interview data is transcribed in detailed. Investigator triangulation satisfied by using several different investigators in the analysis process. Transcribes of the interview were read by different expert and they negotiated in 85%. Also, transcribes were analysed in detail by the two expert in order to determine the categories

4. Results

Results of the study showed that visually impaired students have little understanding about problem solving especially in understanding and transform them to equations. They can calculate simple calculation from their mind, but in complex calculation they have some difficulty. Because they did not able make concrete construction of equal sign in their mind and they have difficulty in interpreting the open number questions.

They have few understanding about the equal sign and they do not have proper intuition about the meaning of the sign. As some of them were taught as equal sign is "space", they have even no idea about the meaning of this sign.

" $8 + 7 = ? + 3$ " is asked to them, a lot of different and most of them answer this question as "15" or "15" and "3" or "only 3" and "18". When it is asked the reasons for that they thought that there will be no number in the right sight or after the "space" so they sum all the numbers up.

When it is asked to students " $10 + 15 = 15 + 10$ ". Some of the students answered that those addition results are not same, that means they cannot reflect to numbers and also have little understanding about relational thinking.

5. Discussion

Result of the study showed that the visually impaired students perceived the equal sign as "a symbol" rather than a relational symbol or operational symbol. Moreover they cannot perceive the meaning of the equality and cannot relate with the other concepts or the context in which the equation sign is used. Moreover they may not perceive the meaning of the equality and cannot relate with the other concepts or the context in which the equation sign is used. As equal sign is taught as "space" in the



lectures they have lack of information about interpreting and writing equations. Hence, teachers should emphasize this misconception in their lesson and equal sign should be made concrete. The reason of such outcome would be said the techniques used in teaching equal sign. When they solve problem if teachers make them to understand the problem and help them to construct accurate information about equal sign and equations, visually students will also be good problem solvers. Moreover, if the right tools and instructions are provided it is possible for blind students to study and understand significant elements of problem solving process hence their critical thinking and scientific operational skills may improve.

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