

CY-ICER2012

Elements of memory

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Abstract

To have information about a concept, one must have all of seven elements of memory and make knots of memory element that all refer to one subject. Because of this reason, examining memory elements of pre-service teachers is important. The purpose of this study is to investigate which elements of memory pre-service chemistry teachers have and how these elements of memory are associated with each other in their minds. This study was designed as a case study conducted with eighteen participants in a university in Turkey in 2010-2011 fall semester. Data obtained from scale indicated that participants mostly had *string*. *Image* was the least one in the memory elements.

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Keywords: Memory elements, pre-service teachers, chemistry education

1. Introduction

If you want to know the meaning of a word like heat, you can look into a dictionary for a definition of it, but that definition is hardly sufficient for you to feel that you understand the term to any substantial degree. To understand, you would want to know about it more. With this regard, to understand a concept, you must have some information about it in your memory (White & Gunstone, 1993). A rich understanding also may be accepted as consisting of all elements of memory (Richardson, 1997). If learning is a process, understanding may be defines as a product of this process (Richardson, 1997). The word ‘understanding’ is complex, involving the amount of knowledge, its type and its degree of interlinking in a person's mind, its availability and its applicability. In understanding, the nature of knowledge and the pattern of associations between its elements are important (Kolari & Savander-Ranne, 2004).

Aristotle regarded the brain as a radiator that makes the blood cool (4th Century). Although we know that it has a greater role on thinking and memory, we do not know how it stores those bits of knowledge. Knowing includes the elements of memory, as described by White. White defined seven types of memory elements used to describe science learning. These are strings, propositions, images, episodes, intellectual skills, motor skills and cognitive strategies and also he suggested that there are not different stores for different sorts of memory (White, 1993). The string is a sequence of words, ideas, numbers and symbols remembered as a whole not to be changed (Atasoy, 2004). The proposition is a description of a property of a concept or of the relation between concepts. The images are mental representations of a perception. The episode is a memory of an event which was participated or witnessed. The intellectual skill is the capacity to perform a whole class of mental tasks. The motor skill is the capacity to perform a whole class of physical tasks. The cognitive strategy is a general skill involved in controlling thinking (White, 1993). According to Osborne (1993) strings are learned by rote; propositions are the description of

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concepts and statements of their relations; images are retained mental pictures and episodes are records of our experience. And he also suggest that propositions, intellectual skills and cognitive strategies aren't subject specific but a powerful set of general purpose procedures which include the ability to analyze, reflect and generalize. Lecturers should be able to help students in understanding the nature of a concept or quantity and develop a sample of associations between the elements of memory. This means forming links between, for example, propositions, images and episodes (Kolari & Savander-Ranne, 2004). Loughran (1996) conducted a case study with teachers who were just finished the education program for three years about the view of their development as science teachers in the process of the study the participants outlined their view of student learning as knowing (recall of concrete), doing (application of knowledge), understanding of context (relating knowledge in one area to another) and questioning how learning occurs (thinking about learning).

Science cannot be thought as Pavlov taught his dog that the food would come after the bell rung as the science isn't a thing that interconnection of two things (White, 1993). To have information about a concept, one must have all of seven elements of memory and make knots of memory element that all refer to one subject (Atasoy, 2004). Because of this reason, examining memory elements of pre-service teachers is important. But, White admits that these strategies are difficult to elaborate and study but that our prospects should be limited as only a small amount of research has been undertaken. Besides that the White's theory hasn't been studied for a long time and the study to determine memory elements of chemistry pre-service teachers hasn't been conducted. For these reasons the purpose of this study is to investigate which elements of memory pre-service chemistry teachers have and how these elements of memory are associated with each other in their minds.

2. Method

This study was designed as a case study conducted with eighteen pre-service chemistry teachers in a university in Turkey in 2010-2011 fall semesters. The participants were to be counted as graduated. For this purpose, fourteen open-ended questions about the subject of acid-base were prepared as a scale. Each of the questions was fixed to measure one element of memory. String and proposition were measured by two questions, episode was measured by one question and intellectual skill and cognitive strategy were measured by three questions. All questions were graded as 0 or 1. It took zero point if it was false and it took one point if it was true. For the content validity, the scale was controlled by two educationalists who are giving doctoral-level course in chemistry education. A coefficient alpha was calculated for the data set since the scale produces dichotomous data. For dichotomous data, the coefficient alpha is equivalent to the Kuder-Richardson-20 (KR20) which uses the method of rational equivalence (determines internal consistency). The coefficient alpha for the scale is .64. The scales of the participants were analyzed by each researcher independently. Consistency for the evaluation of participants' answers was 91% agreement between the researchers. The researchers resolved all disagreements by discussion until 100% agreement was reached. As the motor skill cannot be measured in paper-pencil test, we made students perform an experiment to observe their motor skills. The experiment process was observed by researchers using a check list controlled by educationalists and was videotaped.

3. Results

Data obtained from scale indicated that pre-service chemistry teachers mostly had *string* with the proportion of 89% and *cognitive strategy* with the proportion of 85%. Also, results showed that 78% of pre-service chemistry teachers had *episode* and 72% of them had *proposition*. *Image* was the least one in the memory elements with the proportion of 55%. The second least memory element was the *intellectual skill* with the proportion of 65%. Distribution of the memory elements can be seen on graph 1.

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