Observation of Cognitive Structure and Conceptual Changes through Word Associations Tests

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SYNOPSIS

INTRODUCTION

In recent years, misconceptions have been identified in students in various science topics such as electrical circuits, dissolution-melting, diffusion-osmosis, chemical changes-physical changes, photosynthesis-respiration and acids and bases. Some of the definitions of misconception in the literature are as follows: ‘different ways of thinking by the students in a topic as compared to the experts in the field’ (Driver, R., & Easley, J., Osbome, R.J., Bell, B.F. & Gilbert, Y.K., quoted in: Bilgin & Geban, 2001). ‘Concepts that are not scientifically true but are explained by students in a manner specific to them’ (Nakiboğlu, 2006).

Many studies include strategies that provide conceptual change which can correct these misconceptions and lead students towards scientific concepts (Bilgin & Geban, 2001; Palmer, 2002; Özmen, 2007). In order to remove the misconceptions which are one of the factors that block meaningful learning, it is important to review the pre-existing knowledge of the students and replace the incorrect notions in their minds to adapt the existing information to the new ones. This is called as conceptual change process (Smith et. al. 1993, cited in Özmen, 2007).

‘Conceptual change’ approach is one of the alternative learning approaches that redesign the misconceptions of students according to Piaget’s educational philosophy (Way & Andre 1991; cited in Özmen, 2007). Postner, Strike, Hewson & Gertzog (1982) adapted Piaget’s theory to their teaching strategies by explaining how conceptual change materializes (Özmen, 2007). Due to this reason, most of the studies in the literature about ‘Conceptual change’ have been adapted to teaching strategies in order to study the effectiveness of the various teaching strategies (Bilgin & Geban, 2001; Blake, 2004; Mikkila, 2001). Conceptual change is normally measured by pre and post concept tests to identify results according to the statistical differences. In recent years, research is mostly focused on how measurements in identifying...
conceptual change and conceptual understanding can be more objective, more reliable and more effective. Also the effect of formats and structures of the tests on success is researched (Ateş & Karaçam, 2008; Sencar & Eryilmaz, 2004).

The impact of the constructivist learning approach of the recent years on the educational settings and the shortages of the traditional assessment-evaluation techniques in identifying conceptual understanding and conceptual change have created various techniques and strategies. Additionally, techniques helping the identification of student cognitive styles and the bonds among concepts, and determining the sufficiency of relationship between concepts have gained importance (Bahar et al., 2006). Word Association Technique (WAT) as one of these techniques has been utilized in many studies in recent years (Bahar, Johnstone & Sutcliffe, 1999; Bahar & Özlü, 2003; Nakiboğlu, 2008). It was used as the data collection technique in this study.

PURPOSE OF THE STUDY

The main purpose of this study is (i) to diagnose the cognitive structure, (ii) to investigate the process of conceptual change utilizing a word association test about the solar system and the space and (iii) to identify the misconceptions.

METHODOLOGY

The study was undertaken with 31 7th graders in a primary school in Bolu City. The study was completed in 2007-2008 Spring Semester and the application phase took two weeks. The participants were willingly participated in the study. WAT was used by the researchers as the data collection technique. The students took WATs at the beginning and at the end of the unit. 6 key concepts were chosen in connection with ‘Solar System and Beyond: Space Riddle’ unit. These concepts were the ones on which the topic was built on and they were thought to be crucial in understanding the unit. In the process of selecting the key concepts, 7th grade Science and Technology Course Books were examined and the concepts were chosen from among the ones that were in accordance with the curriculum. Expert opinions were also sought in the selection of these concepts. In the application process, concepts were placed in such a way that each concept was given in a separate page. The answers given for the key concepts were analyzed in detail in order to evaluate the results of the pre and post tests. A frequency table showing the frequencies of the usage of the words and concepts was prepared. Based on this frequency table prepared according to the data obtained from the pre and post tests, a concept map was created.

FINDINGS

When the post test concept map was analyzed, it was seen that key concepts appeared much earlier which pointed to the fact that conceptual change and development had taken place. Accordingly, it was found that misconceptions were clarified and the links among key concepts increased which showed that the teaching approach was effective and efficient and it provided conceptual change to a great extent. When the student-sentences related to key words were examined, it was seen that sentences with more scientific facts in the post-test replaced with the sentences in the pre-test that were unscientific, superficially informative sentences with misconceptions.
RESULTS and DISCUSSION

One of the alternative assessment and measurement techniques; word association technique (WAT) was examined in order to determine its effectiveness in identifying the cognitive structure, misconceptions and conceptual change in students before and after teaching. When the pre and post test frequency tables and concept maps were analyzed, it can be said that WAT is an effective technique in the identification of cognitive structure, conceptual understanding levels and misconceptions in students. The results of this study show parallelism with the other studies’ findings in literature on different topics and learning fields (Bahar, M., Johnstone, A.H. & Sutcliffe, 1999; Bahar & Özatlı, 2003; Nakiboğlu, 2008). The finding that WAT is an effective technique for examining the pre and post knowledge, misconceptions and conceptual change can be generalized.

REFERENCES


