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An investigation of the relationship between performance in the problem-solving laboratory applications and views about nature of science of pre-service science teachers

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Abstract

Teacher education programs have met with limited success in improving teachers' understanding of the nature of science (NOS). Research suggests that such efforts could be enhanced by addressing NOS in pre-service teachers' science courses (Hanuscin, Akerson, & Phillipson-Mower, 2006).). In the extent of the study it has been aimed to search, a) students' views about nature of science, b) the effect of problem solving applications in the science laboratory on 40 pre-service science teachers' knowledge and their perceptions about nature of science. In the study, Evaluation Form of Problem Solving Skills (EFPSS), Evaluation Form of Student Reports (EFSR), The Beliefs about Science and School Science Questionnaire (BASSSQ) and Views of Nature of Science Questionnaire (VNOS-C) have been used as data collection tools. The knowledge of the students about the Nature of Science was determined by evaluating the answers of the students to BASSSQ subsequent to the problem-solving implementations within the context of science laboratory.

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Keywords: Nature of Science, Problem solving, Science laboratory applications

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1. INTRODUCTION

One of the main reasons why students receive science education is to bring them to a literacy level in science. Scientific literacy is defined as to know the nature of science, to understand how knowledge is obtained, to comprehend that knowledge depends on known facts, which change as the new proofs are collected, to know the basic concepts, theories and hypothesis in science and to perceive the difference between scientific proofs and personal opinions (Ayas, Çepni, Johnson & Turgut, 1997).

There are different definitions for problem solving in many literatures. Gagne (1970) differentiated problem solving as the highest level of learning from the problem solving skill as the unavoidable life skill. According to Wheatley (1984), problem solving is what you do when you don't know what to do. Gagne (1977) expressed problem solving as a thinking process, where students discover the composition of previously learnt principles to solve a problem. Ashmore, Frazer and Cassey (1979) defined problem solving as the result of the implementation of certain knowledge and principles to understand a problem. Perez and Torregrose (1983) considered problem solving as a scientific research task. Mayer (1997) perceived problem solving as a synonym of thinking. Heppner (1982) used problem solving as a synonym for coping with problems. According to Cardellini (2006), problem solving is more than integrating numbers into well-known formulas. ıt is related to creativity, comprehensive thinking and formal knowledge (Temel, 2009).

1.1. Problem solving approach in the laboratory

According to Chiappetta and Koballa (2002), various approaches have been developed in recent years to increase the productivity of laboratories along with turning them into environments where meaningful learning occurs. One of these approaches is the problem solving approach in the laboratory. By using this approach, chemistry curriculum has been revised to allow for more purposeful utilization of laboratories (Wilson, 1987). Laboratories are ideal and productive environments to implement technical concepts into the real life contents (Gallet, 1998). However, traditional chemistry experiments are carried out in a way that does not require much thinking or preparation. Students participate in laboratory activities in the same way as following the instructions of a recipe (Neeland, 1999). With the aim of correcting this mistake, certain chemistry educators reached to better conditions by using the problem solving approach in the laboratories (Wilson, 1987).

1.2. The Nature of Science

The nature of science has become the basic component of chemistry education programs in certain countries such as the USA (AAAS, 1990; 1993; NRC, 1996) and the UK (DFE, 1995, Millar & Osborne, 1998). Various researchers emphasize that the nature of science is closely related to the science education. Understanding the nature of science and overcoming both social and scientific events is the basic purpose of the science education (Tao, 2003; Sadler, 2004; Bora, 2005). The nature of science and the nature of scientific knowledge construct the two dimensions of the scientific literacy (Meichtry, 1999). A scientifically literate person is defined as an individual who can make conscious decisions using scientific knowledge, concepts, laws and processes in terms of science and technology (Abd-El-Khalick, Bell & Lederman, 1997).

Showalter (1974) made use of the terminology as uncertain, general, repetitive, probable, humanistic, single, holistic, historical and experimental in defining the nature of scientific knowledge. Having scanned the literature on the scientific knowledge, Rubba and Anderson (1978) united these nine factors under a 6-factor model called the nature of science model. These factors are: moral (scientific knowledge cannot be judged as good or bad), creative (scientific knowledge is partly a product of an individual's creativity), developmental (scientific knowledge is not the absolute truth), simple (scientific knowledge is not complex), testable (scientific knowledge