Examining the Effect on Development of Pre Science Teachers' Argument Structure of Writing the Argumentation Based Experiment Report

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Extended Summary

Introduction: Inquiry is centered on learning within science education reform studies in the last years and emphasizes that learner constructs his/her own knowledge. National Science Education Standards (NRC, 1996) states that inquiry based approach is a central component for learners to become active participants in their learning process and to use scientific thinking processes more effectively. Inquiry based science education as a way of improving learning process requires to think like scientists. This construction should reflect a change such as making claims based on evidence that directs scientific argumentation process and it is different from traditional teaching approach (Martin and Hand, 2009). The emphasis on scientific inquiry in science education presents the change based on argumentative and explanatory knowledge construction. From this perspective, the development of scientific knowledge is dependent on connecting inquiry targets and argumentation practice (Zembal-Saul, 2009). Argumentation is a scientific practice as a learning construction by thinking, writing and explaining, individually or in groups (Sampson, 2009). Argumentation Based Science Learning (ABSL) approach is based on inquiry to simplify learning in laboratory activities. It uses oral and written arguments and is a theoretic integration of writing and discourse (Hand ve Keys, 1999). In this respect, the aim of the study is to examine the development of argument structures in students' scientific reports in laboratory practice class.

Methodology: This study incorporates a process that states how prospective science teachers' qualitative statements in their laboratory reports can be evaluated in terms of quantitative data. The participants of the study were 46 prospective science teachers (Grade 2) in a state university in Turkey. The study is conducted in fall semester of 2012-2013 academic year. 25 male and 21 female students were participated. Students' written reports template which is used typically in Argumentation Based Science Learning approaches was used in order to collect the data. (Choi, 2008; Hand and Choi, ; Kıngır and others, 2011). When analyzing the data, a rating scale developed by Choi (2008) was benefited with the aim of converting the qualitative data into quantitative data (Appendix 1). The rating scale includes the constructs that underline argumentation components and the unity between these components. In the grading scale, every dimension enables evaluation between 1 to 5 points to represent properties of a particular number and qualification. T-test Statistical technique (in SPSS 17 programme) was used to analyze the data. The data were examined by the two researchers to be ensure of interval consistency.

Findings: The quality and scientific validity of Question, Claim and Argument component based on Argumentation Based Science Learning approach shows a significant development in five weeks and in the

particular implementation topics. When analyzing prospective teachers' reports in terms of the relationship between Question- Claim, the mean value of the first activity (Different Cell Structure) is calculated as 1,32, the mean value of the second activity (Organic Matter Content) is calculated as 1,71, the mean value of the third activity (Cell Divisions) is calculated as 2,41, the mean value of the fourth activity (Blood Cells) is calculated as 2,91 and the mean value of the fifth activity (DNA isolation) is calculated as 3,32. When analyzing prospective teachers' reports in terms of the relationship between Claim- Argument, the mean value of the first activity (Different Cell Structure) is calculated as 1,17, the mean value of the second activity (Organic Matter Content) is calculated as 1,76, the mean value of the third activity (Cell Divisions) is calculated as 2,19 the mean value of the fourth activity (Blood Cells) is calculated as 2,80 and the mean value of the fifth activity (DNA isolation) is calculated as 3,21. The mean values of prospective teachers' integrated thinking construct are calculated as ; for the first activity (Different Cell Structure) 2,21, the second activity (Organic Matter Content) 3,82, the third activity (Cell Divisions) 5,34, the fourth activity (Blood Cells) 6,04 and the fifth activity (DNA isolation) 6,21. Depending on the these findings, prospective teachers' arguments based on the activity show a development in a five week time when evaluating them in means of integrated thinking construct.

Discussion: The study presents an analysis of writing reports based on Argumentation Based Science Learning approach is more effective than traditional laboratory reports on students' learning. The quality of the questions which lead to students' learning designs show a significant increase in every experiment procedure. It is important for students to investigate their own learning process in order to attain meaningful learning in science education. In this manner, it is an important stage for prospective teachers to construct the process by asking questions that will reveal their learning expectations (Hand and others, 2007). In the implementation, the qualitity of the Claim component in students' reports increases with the ongoing process. Cavagnetto and others (2009) evaluated the quality of the claim component as an important pedagogical stage in terms of the unity of inquiry based learning and the expectation towards the process in their study. There has been a development in the quality of students' questions and their claims based on the process. Researches related to argumentation based science learning indicate that students need strong evidence in order to support their claims (Choi, 2008). The research findings present using argumentation based science learning approach in laboratory practice contributes supporting students' meaningful learning and developing their conceptual understanding (Hohenshell and Hand, 2006; Yore and others, 2003; Cronje and others, 2011). Integrating Argumentation Based Science Learning approach into the laboratory process is a new and interesting perspective which helps assimilation of scientific knowledge.