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Transition between Open and Guided Inquiry Instruction

Arzu ARSLAN*

Marmara University, İstanbul, Turkiye

Abstract

Scientific inquiry refers to activities in which knowledge and understanding of how scientists study the natural world. Depending on how much teacher structure is supplied and whether there is an already existing solution to the problem or question, inquiry was classified as confirmation, structured, guided and open inquiry. The research aims at presenting the instance of transition between guided and open inquiry. This study was carried out with 25 pre-service teachers at a state university. Two activities were practiced. During the activities, pre-service teachers designed their own experiments, made researches about their concepts and made argumentation about experiments. When applying open inquiry appeared difficulty, guided inquiry was applied. These difficulties were 1) Absence of science process skills as formulating hypotheses, research questions and defining variables. 2) Pre-service teachers met for the first time with an inquiry based laboratory. 3) When researching about concepts and associating their experiments with works of scientists, they did not know where and how to start research.

Keywords: Open inquiry, guided inquiry, physics education, pre-service teachers;

1. Introduction

Inquiry based teaching requires students to develop questions and hypotheses, collect data, analyse data, draw and test conclusions (NRC, 1996). Scientific inquiry refers to activities in which knowledge and understanding of how scientists study the natural world (NRC, 1996).
Inquiry-oriented instruction is described as an active process involving making observations, posing questions, examining books and other sources of information to see what is known, planning investigations, reviewing what is already known in light of experimental evidence, using tools to gather, analyse and interpret data; proposing answers, explanations and predictions and communicating the results; in contrast to instruction in which students

* Corresponding Author: Arzu Arslan
E-mail address: arzfizik@gmail.com

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record information presented by teachers and memorize scientific facts and formulas (Smith, Desimone, Zeidner, Dunn, Bhatt & Rumyantseva, 2007).

Inquiry includes cognitive and sociocultural views of knowledge construction (Anderson, 2002; Cakir, 2011). It is supported with four items specified by Anderson (2002):

- Learning is an active process of individuals constructing meaning for them; significant understandings are not just received.
- The meanings each individual constructs are dependent upon the prior conceptions this individual already has. In the process, these prior conceptions may be modified.
- The understandings each individual develops are dependent upon the contexts in which these contexts are, the richer are the understandings acquired.
- Meanings are socially constructed; understanding is enriched by engagement of ideas in concert with other people.

These factors are understood as learning process by using constructivist terminology (Anderson, 2002; Cakir, 2011). In inquiry, it is essential that students should manage their own learning process.

1.1. Inquiry Openness Levels

Depending on how much teacher structure is supplied and whether there is an already existing solution to the problem or question, laboratory activities can be classified by level of openness to inquiry. According to whether the teacher prescribes the problem, the apparatus to be used, the procedure to be followed and the expected answer, or the students are required to make these decisions for themselves, a scale of openness to inquiry has been developed to classify laboratory activity (Baillie & Hazel, 2003; Kılınc, 2002). The scale was first formed by Schwab (Kılınc, 2002) and then four-level categorization was described by Herron (Smithenry, 2010). In the first level, confirmation inquiry; a question and a procedure which to answer it are given to students, they follow the procedure and confirm an answer which they knew beforehand. In the second level, structured inquiry; a question, a problem or and an outline are provided by teachers, but students do not know their answers (Smithenry, 2010; Spronker- Smith, Walker, Batchelor, O'Steen & Angelo, 2012). In the third level, guided inquiry; the problem is given to students, but they are self-directed in terms of designing procedure and exploring the answers (Smithenry, 2010; Spronker- Smith et al, 2012). In the fourth level, open inquiry; students formulate the complete project; they develop a question, identify what must be known, design their own experiments, interpret results, and evaluate reliability and validity of the study (Baseya & Francis, 2011; Smithenry, 2010; Spronker-Smith et al, 2012).

It should be understood that all inquiry levels are not same and equal. A important question is ''How much information is given to the student? '', in the openness scale of inquiry, activities can range from teacher-centred to student-centred (Bell, Smetana & Binns, 2005). The openness scale was shown in the Table 1.

Table 1. Four-Level Model of Inquiry (adapted from Bell et.al)

Level of inquiry	Question	Method	Solution
Confirmation Inq (1)	Given	Given	Given
Structured Inq.(2)	Given	Given	Open
Guided Inq (3)	Given	Open	Open
Open Inq.(4)	Open	Open	Open

In table 1, confirmation and structured inquiry can be described as ''cookbook laboratory', because all procedures are given to students like recipe. In contrast, guided and open inquiries are more complex for students because students design their own experiments and procedures (Smithenry, 2010). Students who engage in guided inquiry may get little practice in designing their own investigations; this inquiry level prepares students to open inquiry and requires students to formulate their own procedure (Bell et. al, 2005). In open inquiry, a subject matter area for investigation is circumscribed by the teacher; students find a problem from this subject and produce their own research questions which are meaningful, testable and consistent with existing theories (Windschitl, 2001). It is