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Characterizing the Teaching and Learning of Inquiry in the Bio-Tech
Program for High School Biotechnology Majors

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“The trouble with school science is that it provides uninteresting answers to questions we have never asked.”

Student in Sweden (Osborne, 2006)

Abstract

Teaching and learning of inquiry lay the foundation for the development of students' scientific literacy. Students are expected to learn about the inquiry process and to develop their understanding of scientific practices by experiencing authentic inquiry in an active learning environment. This research examined the teaching and learning of inquiry in an innovative program for 11th grade biotechnology majors entitled the Bio-Tech. The study involves characterization of the Bio-Tech program while focusing on the teaching and learning of asking questions and critiquing practices, exposing gaps between the intended and the implemented Bio-Tech curricula, and exploring the participants' views towards the inquiry level and authenticity of the program. An inquiry programs assessment tool, entitled I-MAP, was developed and used for the characterization of the Bio-Tech program.

The results show that some of the Bio-Tech students' asking questions and critiquing abilities improved following their participation in the program, mostly their ability to use metalanguage of science terms in their questions and arguments, and their ability to focus their questions and critiquing arguments on the experimental process. Analysis of the communicative approach and lesson structure of two Bio-Tech lessons revealed that students' ability to formulate research questions appropriate for investigation was better developed in a student-centered, dialogic and interactive lesson than in a teacher-centered, authoritative and non-interactive lesson. Some gaps were revealed between the intended and the implemented Bio-Tech curricula, mostly in the initial stages of the program that were expected to reflect higher levels of student independence, while the enacted curriculum was more teacher-guided. Most of the Bio-Tech participants viewed the level of inquiry in the Bio-Tech program as high and authentic in the stages of formulating research questions, performing the experiments in the research institute, and writing the research portfolio. Some inquiry stages were viewed as reflecting low inquiry level, such as planning the main experiments and presenting the results, due to time and experimental tools limitations.

In line with recent calls for shifting from inquiry teaching to teaching scientific practices, the characterization of the Bio-Tech program indicate that participation in an inquiry-oriented program, such as the Bio-Tech, may improve students' scientific practices while experiencing high level and authentic inquiry.