

Will separating the methodology from the research question help promoting students' inquiry skills?

Eilat Hasson

Advisor: Anat Yarden

In school laboratory lessons, the "cookbook" approach is still the dominant teaching method. Students primarily "follow instructions" with no clear notion of the aim of their investigation or the connection between the aim of the lab and their technical efforts. A "learning by inquiry" approach to lab activity, where students engage in asking relevant questions and attempt to answer them, is suggested as an approach to promote meaningful learning, conceptual understanding, and the understanding of the nature of science. However, efforts to introduce this approach had only a marginal effect on everyday practice at schools for various cultural, competence and administrative reasons. Moreover in the inquiry-based approach students are often expected to come up with the experimental procedures. This is particularly difficult in biology as many methods were discovered by trial and error, do not have a clear rationale behind them and thus are very difficult to reconstruct (e.g. bacteria gram staining or various media for growing bacteria).

We are developing a set of lab activities in microbiology which accompany the learning materials for biology majors (11th-12th grades). Each written lab activity is divided into two: i) a generalized protocol (e.g. "methods for staining bacteria"); ii) the aim of the specific lab activity (e.g. "The current activity aims to characterize 3 different species of bacteria by microscopic methods"). Most of the activities are designed for school labs. However, one of the activities in the manual will take place in the Davidson institute as part of the "Nechmad" project (The Center for Inquiry Labs), allowing the introduction of more advanced equipment and methods. This inventory of methods can then serve as a common background students and teachers have, with which to work on an inquiry based concluding activity. The divided structure of the suggested lab manual has several purposes: i) to separate more clearly between the questions asked and the methods to answer them; ii) to demonstrate better how scientific knowledge is developed in the scientific community; iii) to allow connection between science concepts discussed in the classroom with the observations done in the lab; iv) to provide students with an inventory of procedures that allows them to answer their own questions.