Students and teachers benefits and challenges in Teacher-Led Outreach Laboratories (TLOL) in contemporary biology

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The importance of modern genetics education in Israel has been recognized in the syllabus for high school biology and biotechnology majors. Learning of modern genetics is challenging and students have difficulties in acquiring a coherent cognitive mental model of abstract concepts as DNA, bacteria or enzyme. This leads to creation of misconceptions and faulty mental models. One of the ways to overcome those difficulties is to conduct laboratory activities by the students. I developed molecular biology laboratory activities, through which high school biology and biotechnology students and teachers can experience modern experiments in biology. In contrast to most outreach laboratories, in which the academic personnel teaches the visiting classes, our laboratory activities are conducted in a unique framework entitled *Teacher-Led Outreach-Laboratories* (TLOL). In this framework the high-school biology teachers themselves teach their own students at our institute laboratories, following an appropriate professional training. One of the laboratory activities I developed in the framework of TLOL focuses on DNA manipulations while linking between gene and phenotype. The purpose of my study is to examine high-school students' comprehension of modern genetics while practicing hands-on experiments and to explore teachers' challenges and benefits, while focusing on teachers' professional development, in the framework of TLOL. Qualitative methodological approaches are used to probe teachers' challenges and professional development in TLOL. Both quantitative and qualitative methodological approaches are used to probe high-school students' comprehension of molecular genetics. Students' written questionnaires, aiming to probe students' visual representations and conceptual understanding of molecular genetics, are handed to the students before and immediately following the laboratory activity. Approximately 4-6 weeks following the laboratory activity, semi-structured interviews with selected students were carried out. In addition, I recorded the discourses that took place during a few laboratory sessions as well as collected observation field notes from laboratory sessions. Using the qualitative tools I was able to show that students' visual representations of DNA and bacteria significantly improved following the activity as well as their procedural understanding with regards to DNA manipulations. Those results were expressed in the students' written responses as well as in their drawings of DNA molecules in test tubes. Students' interviews revealed that student' visual representations improvement in molecular genetics was retained a few weeks following the activity.