

The development, implementation, and assessment of the learning module "Brain, Medicines, and Drugs" in high schools in Israel

Thesis for the Degree Doctor of Philosophy

Submitted to the Scientific Council of

The Weizmann Institute of Science

Rehovot, Israel

By Dvora Cohen

April, 2001

Abstract

This work describes the development, implementation, and assessment of a new module entitled "Brain, Medicines, and Drugs", developed within the framework of a new science curriculum intended for non-science oriented students in upper secondary schools in Israel. This interdisciplinary program, is based on the philosophy of S.T.S. (science-technology-society). It is interdisciplinary in nature, since it integrates concepts from various science disciplines, technological applications, and societal issues. This module reflects the belief that science should be learned by all students. Moreover, science should be an integral part of the education of citizens living in society that is influenced by scientific discoveries and their technological consequences.

Thus, the main goals of this thesis are the following:

- To develop the module "Brain, Medicines, and Drugs."
- To implement the module in high schools in Israel among students who opted not to specialize in sciences.
- To assess both the process and the educational effectiveness of the development and implementation of this module.

The development of the module "Brain Medicines, and Drugs" was spiral and involved several consecutive stages. Each cycle consisted of the development of a new version of a handbook for the students and the professional development of those teachers who volunteered to teach the module in their classes. Also, in each stage the teachers obtained guidance and support regarding the module's implementation and the problems they encountered. They contributed ideas for teaching the module, thereby providing valuable feedback. Each developmental stage was based on the results obtained in the formative assessment that was conducted in the previous stage. In learning the module, the students obtain

multidisciplinary, updated and relevant scientific information, ideas, and concepts regarding the brain and the influence of medicines and drugs on its function.

The Implementation of the program was concerned mainly with the professional development of the teachers. In general, high school teachers in Israel are trained to teach the various science disciplines. However, teaching an interdisciplinary course is usually not included in their pre-service training, nor is it part of their in-service experience. In addition, teaching such a module requires using a variety of teaching strategies, with which many teachers have little experience. In implementing the module, the teachers received pre-teaching training and continuous support.

In teaching the module, a great effort was made to improve the classroom learning environment. This was done by introducing various types of instructional techniques such as classroom debates and discussions, relevant educational films, group-work, peer instruction, simulation games, and case studies. All these instructional techniques were developed as an integral part of the curriculum package. In developing the curriculum, much effort was made to provide the students with a meaningful and enjoyable learning experience. In addition, effort was made to enhance the scientific literacy of the students.

The process of implementation was accompanied by a comprehensive and intensive assessment project. The aim of the assessment was to address research questions regarding the following aspects: (a) the learner, (b) the teacher, and (c) the content. The program was assessed during three consecutive academic years (1998-2000), in 24 schools throughout the country. The research population consisted of 660 students and 24 science teachers. To assess the program we combined qualitative and quantitative methods, and designed and developed the research tools to align with the research goals defined.

Main Findings

As a result of the assessment of the students and the teachers, it was found that

- Students are curious and interested to learn about the brain and the effect that chemicals and drugs have on it.
- When students are exposed to information, they try to make sense of it and interpret their world with the obtained knowledge.
- Teaching this module presents the science teacher with challenges, Positive experiences as well as difficulties.
- Teachers reported that teaching the module is an enjoyable experience, and that they will continue teaching it in the future.
- Learning this module improved students' attitudes toward 'science', 'learning about the brain', and 'learning about the effect of drugs on the body.'
- Learning this module improved students' general knowledge and thinking skills, by which they can better explain the scientific process, scientific phenomena, and more specifically, the effects of drugs on human functions.
- We have found that by learning the module, students' knowledge of key concepts introduced in the module increased to a great extent.

- We consider the reported improvement in students' knowledge and attitudes to contribute to the students' sense of well being, personal progress, and positive experience toward school science.
- Students reported that learning this module, had affected them personally in a positive manner.
- By learning the module students improved their ability to distinguish between myths and science, which is an important component of scientific literacy.