ABSTRACT. This study focused on teachers’ transfer of a variety of teaching methods from a teaching module on nanotechnology, which is an example of a topic outside the science curriculum, to teaching topics that are part of the chemistry curriculum. Nanotechnology is outside the science curriculum, but it was used in this study as a means to carry out a change in the way chemistry teachers teach. The participants in the study included nine high school in-service chemistry teachers. Three research tools were used: (1) semistructured interviews that were conducted with the teachers, after they had finished teaching their nanotechnology module, and follow-up semistructured interviews that were conducted 2 years after the teachers had taught the nanotechnology module, and teachers’ assessment and evaluation of their own teaching method, determining how the nanotechnology modules influenced the students who learned according to this program. The data collection process continued for 5 years. Most of the teachers indicated that they continued teaching the nanotechnology module that they designed and all of them stated that they integrated the unique teaching methods into their teaching of chemistry. High efficacy beliefs were built based on the self-evaluation process that was part of the teachers’ professional development program. Teaching self-efficacy beliefs and organization efficacy beliefs was found to contribute to teachers’ sustainable changes. The findings in the current research are only limited to the topic of nanotechnology; however, we believe that similar results can be obtained for any modern scientific topic that is outside the high school science curriculum. We suggest that more research should be done to determine whether the same findings emerge by using the same approach but on another topic.

KEY WORDS: chemistry teachers, nanotechnology education, professional development, reflection, self-efficacy, sustainable change, teaching efficacy, variety of teaching methods

In 1852 John Dewey stated “If we teach today’s students as we taught yesterday’s, we rob our children of tomorrow.” However, it is well known that often teachers teach as they were taught. As Putnam & Borko (2000) explained: “How a person learns a particular set of knowledge and skills, and the situation in which a person learns, become a fundamental part of what is learned.” (Putnam & Borko, 2000, p. 4). New teaching methods, different teaching strategies, and reforms in science education are usually abandoned after the intervention period (Loucks-Horsley, Stiles & Hewson, 1996). Nanotechnology, an emerging area, provides an
opportunity to deal effectively with this problem. Most of today’s teachers completed their training before the advent of nanoscience and therefore never formally studied it. We assume that providing the teachers with a course that uses a variety of teaching methods may motivate them to use those methods while they teach nanotechnology and their lessons in other sciences may benefit from the variety of new teaching methods introduced. This assumption will be examined in the current study.

“Introduction to Materials and Nanotechnology” is an advanced nanotechnology course designed to introduce high school teachers to nanoscience, to generate teacher interest, and to increase chemistry teachers’ nanoliteracy by providing them with the basic principles of nanoscience (Blonder, 2011). The course was conducted twice during the past 4 years, and introduced 26 chemistry teachers to nanotechnology. It included a unique component called adaptation to education in which the nanotechnology content was presented using a variety of teaching methods (e.g. simulations, teaching models, and short videos). As a result of the course, different educational initiatives were developed by the participating teachers as a way of introducing nanotechnology to their students (e.g. Blonder & Dinur, 2011).

The main goal of the current study was to determine whether or not the use of a variety of alternative teaching methods in the implementation of a nanotechnology module can convince teachers to transfer those methods to their everyday science teaching.

Theoretical Framework

During the last decade, nanotechnology courses for science teachers have been developed around the world (Jones, Blonder, Gardner, Albe, Falvo & Chevrier, 2013). A few programs for teachers’ professional development in nanoscience and nanotechnology are described in the literature. Tomasik, Jin, Hamers & Moore (2009) designed an online professional development course for teachers, including eight weekly sessions and a final project in which each participant created a nanoscience module for their classroom, which was peer-reviewed by other participants. They found that the teachers gained significant learning during the 8-week course and that the virtual course environment was effective as face-to-face interactions. Similar results were obtained by Nichol & Hutchinson (2010).

Blonder (2011) described a comprehensive course for chemistry teachers, aimed at enabling chemistry teachers to become nanoliterate by introducing them to the basic principles of nanoscience, enabling them to study any subject in nanoscience. Teachers’ knowledge of nanotech-