Chapter 9
Enhancing Students' Motivation by STEM-Oriented, Mobile, Inquiry-Based Learning

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ABSTRACT

STEM education promotes scientific inquiry and engineering design, including mathematics, incorporating appropriate technologies. Portable technologies motivate active learning of students and enable accessing to learn resources, facilitating cross-disciplinary designing tasks. This chapter initially presents theoretical approaches of STEM education, mobile learning, and inquiry-based learning, and then it describes an inquiry-based short-term intervention that took advantage of portable digital devices in a STEM class. The aim of the intervention was to study its affection on students' motivation about physics. Results indicate that students who participated in the activity had higher motivation scores than their classmates who attended lessons with conventional teaching methods. The findings also show that the students involved in a guided inquiry-based process became more profoundly engaged in STEM than their classmates who followed a structured inquiry process. Other factors, such as grade point average (GPA) and gender, did not seem to affect student motivation.

DOI: 10.4018/978-1-6684-3861-9.ch009

INTRODUCTION

Education in the 21st century has been driven by teaching and learning processes regarding STEM approaches that provide students with skills in integrating all aspects of learning. STEM education leads students to easily gain knowledge of concepts in authentic problems, using technology, deploying scientific knowledge, managing data by mathematical reasoning, and practicing engineering (Prasongsap et al., 2020). As ICT competency is an important skill that should be developed as one of the 21st century skills, any form of integration in today's situation is incomplete without the digitalization of classrooms (Deák et al., 2021). Especially, mobile technology, namely tablets, smartphones, or wireless sensors, motivates an active, exploratory, and inquiry-based learner-centered learning, as well as collaborative work and creativity (Prasongsap et al., 2020). Although increasing attention on the importance of STEM education has been worldwide stated, difficulties related to lack of time, resources and trained instructors greatly hinder the potential of developing and implementing STEM activities. Thus, it is suggested that ICT, especially mobile technologies, could overcome these difficulties and complement the practice of different activities under formal and informal learning settings (Yeung & Sun, 2019).

We could define Inquiry-based learning as a process in which students propose questions, formulate hypotheses, investigate, and test experiments or observations (Pedaste et al., 2015). Inquiry-based learning is a self-directed learning process which emphasizes active participation and students' responsibility for discovering knowledge (Wilhelm & Beishuizen, 2003). The future of pedagogy in STEM classrooms will be governed by how efficiently educators can present their content knowledge in collaboration with e-learning tools and develop inquiry-based learning in classrooms (Deák et al., 2021). Mobile technologies in inquiry-based STEM learning can give observable benefits to the learning process of students in several aspects and their achievement (Yeung & Sun, 2019).

Mobile inquiry-based learning (mIBL) aims to exploit mobile technology to aid the inquiry process, exchange information, and motivate learners to obtain knowledge building and sharing procedures (Yang et al., 2020). Thus, in this framework, motivation can be defined as an individual's desire to learn concepts or complete learning tasks in mobile Inquiry-based Learning (mIBL). Especially in a science-learning context, the motivation is a crucial issue as it could be described as an internal state that stimulates, conducts, and assists science-learning behavior (Glynn et al., 2011). MIBL should be used with appropriate technology support and teaching strategies, as STEM education, in order to promote students' motivation (Yang et al., 2020).

In this book-chapter we start by a brief Literature Review on the concepts of Inquiry-Based Learning (IBL), Mobile Learning (m-Learning), Mobile technology-supported Inquiry-based Learning (mIBL), STEM education and especially their integration and its advantages. Then a STEM-driven mIBL intervention held in the 3rd High School of Kavala, in Greece, and its effect on student motivation will be presented and analyzed.

BACKROUND

The Background consists of a brief literature survey on the various aspects of STEM education and Inquiry-based Learning in the Mobile Area and on the methods for enhancing the students' motivation.