Extended Summary
Effect of Designed Materials According to 7E Learning Model on Success of High School Students in Modern Physics
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Introduction
Blackbody Radiation (Planck, 1900), Photoelectric Effect (Einstein, 1905), and Compton Scattering (Compton, 1923) phenomenon indicate evidence about that light consists of particles called photons. These phenomenons led to emergence of the modern quantum theory. Additionally, it is thought that the subjects of modern physics, being one of the high school 11th grade study units, are more abstract in comparison to other physics subjects and therefore more difficult to learn. Literature shows that studies on identifying the misconceptions of students in relation to quantum physics concepts and more effective teaching and learning of quantum physics concepts has become an area that attracts the interest of physics education researchers in the past years (Ayvacı, 2013; Çalışkan, Selçuk & Erol, 2009; Escalada, 1997; Özcan, 2011; Özdemir, 2008; Özdemir ve Erol, 2008; Sadaghiani, 2005; Şen, 2002; Vadvnere & Joshi, 2009; Yıldız, 2009; Yıldız & Büyükkasap, 2011a; Yıldız & Büyükkasap, 2011b). Such studies determined that students perceive the quantum lessons as difficult and hard to understand (abstract), that quantum concepts are not learned sufficiently and the learned concepts were not permanent (Didiş, Özcan & Abak, 2008; Didiş, Eryılmaz & Erkoç, 2010; Özcan, 2011; Steinberg, Wittman, Bao & Redish, 1999; Singh, 2001; Singh, Belloni & Christian, 2006; Zhu, 2011). The complex mathematical infrastructure, abstract and non-parallel to each other concepts of the quantum physics were determined to be among the difficulties experienced in learning the subject (Akarsu, 2007; Akarsu 2011; Didiş, Eryılmaz & Erkoç, 2010). For most students quantum physics is defined as based only on mathematical formulas and difficult to understand (Styer, 1997). As a result, it is noted that under the effect of many misconceptions, students exhibit very low rate of success (Didiş, Özcan & Abak, 2008; Singh, Belloni & Christian, 2006; Styer, 1997; Yıldız & Büyükkasap, 2011a). Additionally, the physics textbooks, based on knowledge-based physics education programs were converted to activity based form. Therefore, sample course
materials that can be utilized by students and teachers are needed. In this study, it is intended to develop class material for students and teachers in accordance with the 7E learning model and investigate effects of the material on students’ achievement for Blackbody Radiation, Photoelectric Effect, and Compton Scattering subjects in Modern Physics Unit.

In this study, it was used quasi-experimental design consisting of experimental and control groups. The quasi-experimental design is frequently used in education researches and is able to be controlled due to the fact that errors or variables that could endanger the internal validity and arising from such sources as date, testing and tools will have the same effect in the experimental and the control groups (Çepni, 2010). The sample composed of 50 11th grade students from Anatolian High School and 1 physics teacher working at this school. Subjects were taught according to 7E learning model in experimental group and traditional teaching was conducted in control group. The application was carried out throughout a 4-week period in 12 academic hours. The study uses the Modern Physics Achievement Test in order to determine the effect of 7E learning model on student success rate in the high school 11th grade Modern Physics Subjects Black Body Radiation, Photoelectric Effect and Compton Scattering. The Modern Physics Achievement Test contains 7 open-ended questions and was applied as pre-test and post-test. The success rate of students was limited by the responses provided by students to the conceptual and operational questions of the success test.

In this study, the 7E learning model caused a positive change in increasing the rate of success among students studying the subjects of Black Body Radiation, Photoelectric Effect and Compton Scattering subjects. In other words, it was concluded that the 7E learning model affects positively the conceptual and computational learning of students. It can be said that education performed according to the 7E learning model allowed to objectify the subjects of black body radiation, photoelectric and compton scattering, to execute the lesson more effectively, to make the lesson more interesting and attractive and therefore resulting in student attendance during the class and their active participation in it.

Citation Information