

The Relation between Material Designs and Creativity of Science Education Pre-Service Teachers: Application Examples from the Instructional Technologies and Material Design Class

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Abstract

It is well known that teachers of the present have to be tech- savvy. Pre-service teachers should be trained with this notion as well. Combining technology with teaching-learning continuum skill is taught in the Instructional Technologies and Material Design Course. The current study tried to establish the importance of the Instructional Technologies and Material Design course for pre-service teachers. This course have proved to be irrevocably crucial for the educational continuum by providing examples of elementary school level Science class educational and instructional materials. Furthermore, a statistically significant relation between material design and creativity was found.

Key words: Material design, creativity, pre-service teachers, science education

Introduction

Educational and instructional materials are used for an effective education. In order for the students to achieve the targeted goals and the program to be successful, educational and instructional materials are essential. Specifically, in the success of the science and technology program educational and instructional materials have an important role (Karamustafaoğlu, 2006). Educational and instructional materials are various means used to accomplish instructional objectives. These tools can vary from chalk and black board to power point presentations (Yanpar Şahin, 2004; Kılıç, 2003; Nalçacı and Ercoşkun, 2005). Educational and instructional materials provide a multi-learning environment, make learning easier, arouse interest, attract attention, reinforce knowledge, save time, solidify knowledge, motivate research, and make phenomena that are not available on site or brought to class understandable (Yalın, 2000; Kutluca and Birgin, 2007; Demiralp, 2007; Şimşek, 2002; Yıldız, 2002). Educational and instructional materials help teachers in order to support education. Materials are also important because they can be used again and again (Yalın, 2002). During the education process it is also important to select and prepare visual

materials as well as educational and instructional materials (Karamustafaoğlu, Yaman and Karamustafaoğlu, 2005). While preparing visual materials instructional objectives and learning outcomes should be taken into consideration, they should provide opportunities for students to practice and perform applications, they should be life-like, they should concretize abstract subjects, they should ascend from simple to complex, they should be appropriate to students' developmental characteristics, they should attract attention to the important points of the topic of the class (Yaşar, 2004). Four principles should be considered while preparing educational and instructional materials: 1. CONTRAST, to differentiate important information; 2. ORIENTATION, to create coherence and comprehensibility of the material; 3. LETTERING, for legibility of the written material; and 4. ARTWORK, for presenting knowledge with visual quality (Rotter, 2006). Preparing educational and instructional materials requires creative thinking skill. Scientists define creativity as doing new, innovative and different things. Moreover, they also say that creativity can be assessed depending on the product. Creativity has four sub-dimensions (Yanpar Yelken, 2009):

- Fluidity; to be able to generate acceptable thoughts, solutions or ideas,
- Flexibility; to be able to bring different dimensions and offer different approaches,
- Detailedness; to detail,
- Originality; to be authentic.

Scientific creativity is adapting possessed knowledge to new situations. In other words, being able to solve problems, hypothesize, design experiments, find technological solutions, generate ideas are examples of scientific creativity (Adelson, 2003; Liang, 2002; Eileen, 1996). It can be said that pre-service teachers who do not possess creative thinking skills will have difficulty solving problems they face when they become teachers (Şahin-Pekmez, Aktamış and Can, 2010).

In the present education system teachers have to keep their students attentive during class. So, it is important for teachers to understand instructional technology and develop educational and instructional materials. Thus, the applied "Instructional Technologies and Material Design" course is quite important for pre-service teachers. One of the course objectives is for pre-service teachers to develop new educational and instructional materials using instructional technologies or for them to be able to evaluate existing materials (Gündüz and Odabaşı, 2004). Multiple studies emphasize that pre-service teachers should be individuals who are able to use technology (Sime and Priestley 2005; Delfino and Persico 2007; Kim and Baylor, 2008). Educational and instructional materials can be prepared computer based as well as hand built. Hand built materials are more effective in learning (Yanpar Yelken, 2009). Due to "Instructional Technologies and Material Design" course the scientific creativity skills of the pre-service teachers develop. Pre-service teachers have a great opportunity to practice teaching during their practicum when they combine their content knowledge with content education knowledge and prepare materials with what they learned in the instructional technologies and material design course.

Methodology

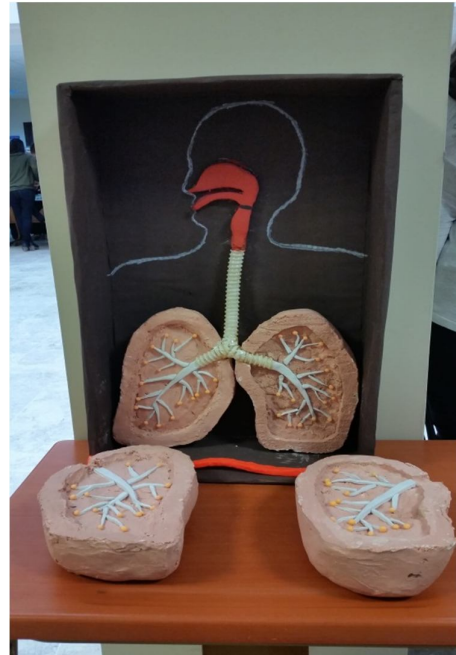
The current study was conducted in Pamukkale University, Faculty of Education, Science Teaching Department with 121 3rd year students attending “Instructional Technologies and Material Design” (ITMD) course during 2014-2015 academic year Fall semester. The ITMD course is offered as 4 (2+2) hours a week. In the first week of the semester students were told what was required of them for the whole semester and they were asked to gain access to Ministry of National Education (MNE) 5th, 6th, 7th, and 8th grade curricula. 3 weeks' period was given to them for material proposals. During these three weeks the ITMD course continued with theoretical background. At the same time, the proposals of materials designed according to the learning outcomes of the topics in the curricula were evaluated and discussed in the class medium. Students usually proposed materials individually; however, since some material proposals were too demanding for a single person it was decided to have students work in groups of two or three. The students whose material proposals were accepted started preparing their materials. Until the midterms, beside theoretical background presentations the videos of students preparing the materials were watched and material preparation stages were monitored. The last six weeks of the semester, students brought their materials to class and presented their topics using their materials. During the presentations, whether the prepared materials met the learning outcomes were monitored. While the students were covering their assigned topics the researcher filled out the relevant evaluation forms. The Evaluation Form consisted of two parts: The first part was the evaluation form taken from the Instructional Technologies and Material Design (Yanpar, 2007) book, and the second part consisted of the four sub dimensions of creativity that were fluidity, flexibility, detailedness, and originality. If the items' requirements were fulfilled by the student's material the student received 1 point, if the material did not meet the requirements the student received 0 points.

Findings

The participants of the study prepared their materials according to the topics in 5th, 6th, 7th, and 8th grades. Some material examples prepared by students according to attainments are given below.

5th grade – The relation of human with the environment

Environmental issues caused by human activities are researched and suggestions for solutions of these issues are given.



5th grade – Nutrients and their properties

Nutrient composition, and the necessity of nutrients for the survival of living creatures.



6th grade- Reproduction, growth, and development in plants and animals

Examples of animals that undergo metamorphosis in their developmental period are given.



6th grade– Respiratory system

The structure and organs that make up the respiratory system are explained using the model.

6th grade – Cell

The fundamental parts and functions of plant cells are explained.



6th grade – Reproduction, growth, and development in plants and animals

Examples of asexual reproducing species are given.



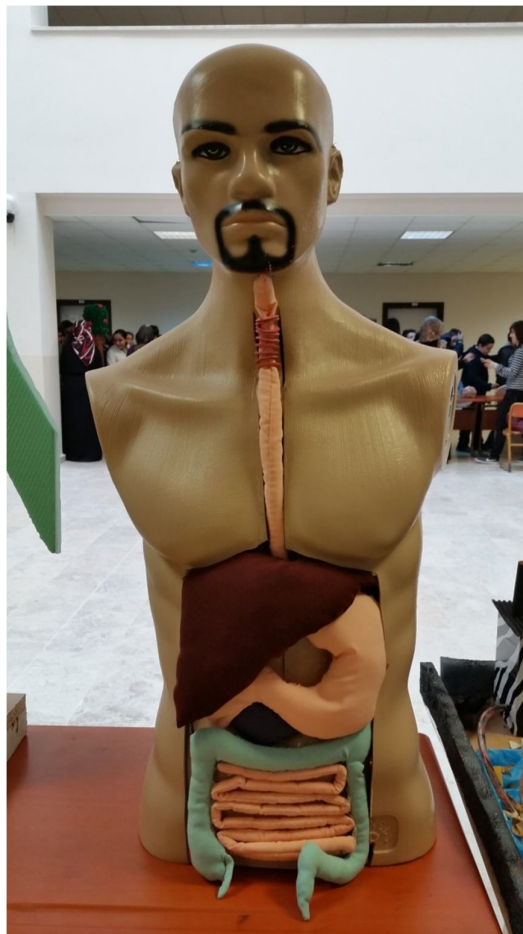
7th grade – Ecosystems

The ecosystem concept is defined and examples are given.



7th grade – The digestive system

The structure and organs that make up the digestive system are explained using the model.



8th grade – Chemical bond

Ionic bond concept is explained.



8th grade – Reproduction, growth, and development in humans

The relation of sperm, egg, zygote, embryo, and baby is explicated.



Moreover, in order to determine whether there is a relation between students' material design and creativity the Pearson Correlation Coefficient was calculated. the Pearson Correlation Coefficient was determined as 0.668 ($p < 0,01$) showing that the correlation between material design and creativity is statistically significant.

Conclusion

The materials students prepared were exhibited at the end of the semester in the “Science Designs Exhibit”. Owing to the theoretical background knowledge students received in the ITMD course students prepared the poster for the exhibit. The exhibit prepared by the researcher and the students was visited by other students from various departments, faculty, elementary school teachers and students. The visitors expressed that they really enjoyed and liked the exhibit. It could be said that this accolade was instrumental in the participant students' self-motivation. Specifically, pre-service teachers who observed how elementary school students enjoyed the classes with materials present, experienced firsthand the benefits of using materials in class. Thus, due to the experience and observations in the exhibit the pre-service teachers learned that they should use more materials when they are presenting topics and experienced it firsthand.

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