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## Designing blended learning environments organized within the basis of web-assisted modeling in science teaching

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### Abstract

A great number of studies on “Matter and Heat” unit have reported that many students have conceptual errors. Studies have shown the necessity of designing and using effective teaching methods in solving such problems. ASSURE teaching design model, which aims to increase the efficiency of material choice and use with systematic prior planning of teaching, was used in creating the materials which were prepared based on web-assisted modeling. In designing blended learning environment, web-assisted activities were used which included mental models as well as analogical and simulation models based on the outcomes of the 6th grade “Matter and Heat” unit. The purpose of this study is to design blended learning environments which are designed based on web-assisted modeling for “Matter and Heat” unit.

Keywords: Science education, web supported teaching, matter and heat, achievement.

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## 1. Introduction

Positive outcomes of science education supported through the opportunities provided by technology make it imperative to make blended learning environments more useful by enriching their content. Learning environments which combine web-assisted learning and face-to-face learning are found frequently in literature (Unsal, 2012; Saritepeci & Yildiz 2014; Balaman, 2015). Enriching the content of such presented blended learning environments to make them more useful has become important. Blended learning environments give students the opportunity to learn at the right time and in the right place (Thorne, 2003). Creating web-assisted environments which provide students with the opportunity to reach the lesson content wherever they want and at their own speed is a very important opportunity for students (Cakir, 2008). In addition, giving students the opportunity to review the subject face-to-face in the classroom and providing them the environment to question their learning will make positive contributions to their learning levels.

It is thought that creating blended learning environments for the “Matter and Heat” unit, which is one of the units of Science lesson that includes important subjects and misconceptions of students, will be useful. A great number of studies have reported misconceptions in students about the subjects of “Matter and Heat” unit (Paik, Cho & Go, 2007; Evrekli, Balim & Didem, 2011; Uzoglu & Gurbuz, 2013; Nas & Cepni, 2016). Studies have mostly reported that students comprehend the concepts of heat and temperature as the same concept and have difficulties in associating concepts such as matter, heat, temperature and change of state with daily life. A great number of studies have reported that modeling technique can be effective in eliminating the misconceptions that occur (Nas & Cepni, 2016). These bring the thought to the forefront that students’ misconceptions can be eliminated by using web-assisted model based instruction in “Matter and Heat” unit. In teaching the subjects of “Matter and Heat” unit, using analogical models as well as simulation models which make it easy to define concepts or processes will be useful.

Using models and modeling in science teaching is an effective method to develop students’ problem solving skills. Modeling has an important function in the development of testing and creating processes besides making great contributions to students’ skills of synthesis and assessment (Lee et al., 2011; Cokelez, 2015). During the process of preparing models such as analogy and simulation, which are commonly used in web-assisted science teaching, an elaborate planning should be made while specifying learner analysis, targets, acquisitions, methods and materials. High level efficiency and effectiveness can be provided through such designed materials. The purpose of this study is to design blended learning environments organized within the basis of web-assisted modeling for “Matter and Heat” unit.

## 2. Method

This study presents a sample blended learning environment design for researchers. Web-assisted modeling techniques were used in the design of blended learning environments. Especially during the process of creating materials designed as web-assisted, using instruction design models constitutes an important dimension of the study. While preparing the materials, a systematic planning should be made for effective and productive use of technology. One of the most suitable models for such a planning is Assure model. In Assure instructional design model, choosing suitable methods and materials in accordance with teaching targets is planned besides determining students’ characteristics. In teaching programs, by using materials designed through the use of this model, students can be made to show high learning performances (Russell, 1994; Uysal & Gurcan, 2004).

## 3. Design of Blended Learning Environments

In teaching environments which are created through the use of technology, the question of for which purposes the material will be used should be answered well. First of all, students with whom the study will be conducted should be analyzed and material design should be discussed starting from this point. At this stage, harmony will be ensured between the material and the student group on

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whom the study will be conducted. The stages followed for web-assisted modeling designed according to Assure instructional design for 6th graders who make up the target group of our study are given below.

Assure model is named by using the initials of the six stages that make up the model (Figure 1).

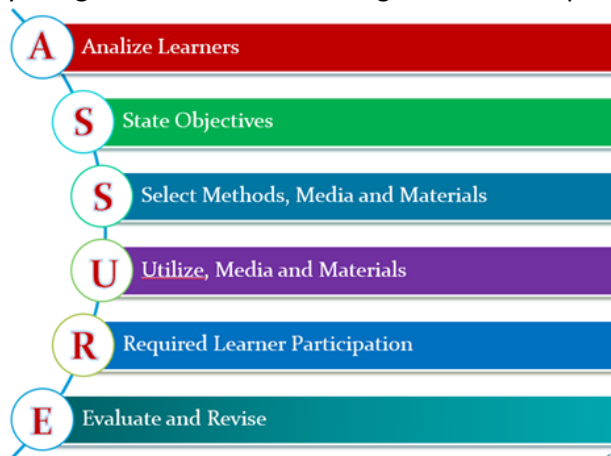


Figure 1. Assure instructional design model

- **Analyze Learners**

- a) General Characteristics;

- i. Between 11 and 12 years of age,
    - ii. A class size of between 25 and 30,
    - iii. Formal operational stage
      - Can do mental processes such as deduction and induction,
      - Thinks with symbols and can make generalizations.

- b) Input skills;

- i. Studied “Change of State” unit at 5th grade,
    - ii. Positive attitude towards science lessons.

- c) Learning Styles;

- i. Visual, verbal mixed,
    - ii. Kinesthetic.

- **State objectives**

There are a total of 7 objectives in “Matter and heat” unit, 4 for the subject of “Matter and Unit” and 3 for the subject of “Fuels” (Table 1).

**Table 1. Number of Objectives and Subjects/Concepts of Matter and Heat Unit**

Unit subjects	Number of Objectives	Recommended hours of class	Subject/ Concepts
Matter and Heat	4	8	Heat conductivity, heat insulation, heat insulation materials
Fuels	3	8	Solid fuels, liquid fuels, gas fuels

- **Select Methods, Media and Materials**

When the factors of students’ number and their characteristics, contents of objectives, subjects of units and time were considered, web-assisted modeling activities were prepared by Adobe Flash software by thinking that it would be suitable to use “show” and “tell” teaching methods.

- **Utilize Media and Materials**

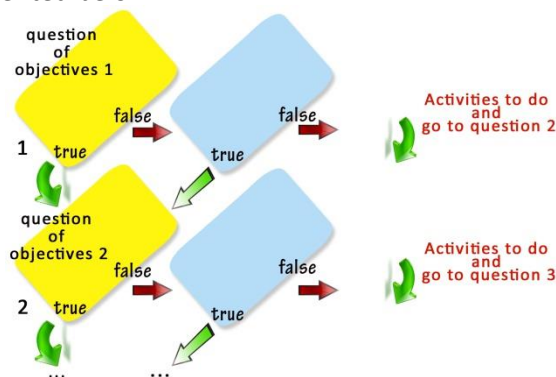
It was ensured that the activities in the prepared material could be used during lecture. The teacher will be able to use projector for this. In addition, students can be allowed to use computer laboratory for individual use. In individual use, students are guided to activities when necessary according to questions and answers.

- **Required learner participation**

In an environment where students will actively participate, question and answer method and web-assisted teaching will be used.

- **Evaluate and Revise**

To assess the students in terms of objectives, activity based measurement and assessment material will be used. Material content and preparation stages are explained in detail below. Web assisted alternative measurement and assessment material developed and designed for blended learning environments can also teach besides measuring. The algorithm of web-assisted measurement and assessment material is presented below.



**Figure 2. Questions and activities plan prepared for measurement and assessment material**

The students are asked to answer questions prepared at the level of objectives as “agree” or “disagree”. When the answer given by the student is not correct, the student is expected to answer again a different question that belongs to the same objective. The student moves on to the next objective when he/she answers the questions correctly. When the answers are not correct, the student is directed to web-assisted modeling activities and expected to complete the activity. There are 7 different activities and 14 questions for a total of 7 objectives of the Matter and heat unit. By this way, all the objectives are checked and the students are made to complete the objectives that they are short of.

All the activities which are prepared based on modeling are presented in a web page and the students are given the chance to do the activity they want whenever they want. The student can use the web-assisted alternative measurement and assessment application whenever he/she wants and as much as he/she wants in order to measure his/her own learning. Below is a sample question and an activity which was prepared based on modeling (Figure 3).

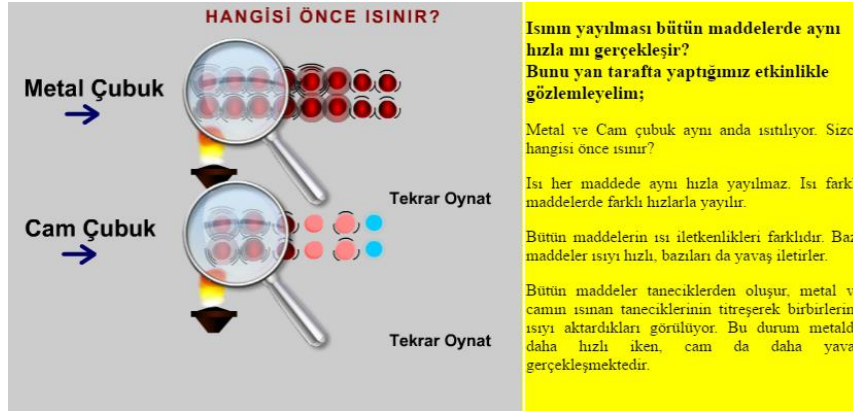


Figure 3. A sample activity

In the activity in Figure 3, a glass bar and a metal bar are started to be heated at the same moment. Here, the students are given information about which bar will be heated first and why this heating takes place in different rates in the bars. In this activity, analogical modeling, which is very effective in terms of turning an abstract event into a concrete event, was used. Degrading the event of the occurrence of heat transmission through the collision of faster moving particles which make up matter with the particles that move slower will make learning and comprehending the concept easier. Activities prepared which are based on this modeling and similar modelings are used as web sites as well as being used in measurement and assessment dimension (Figure 4).

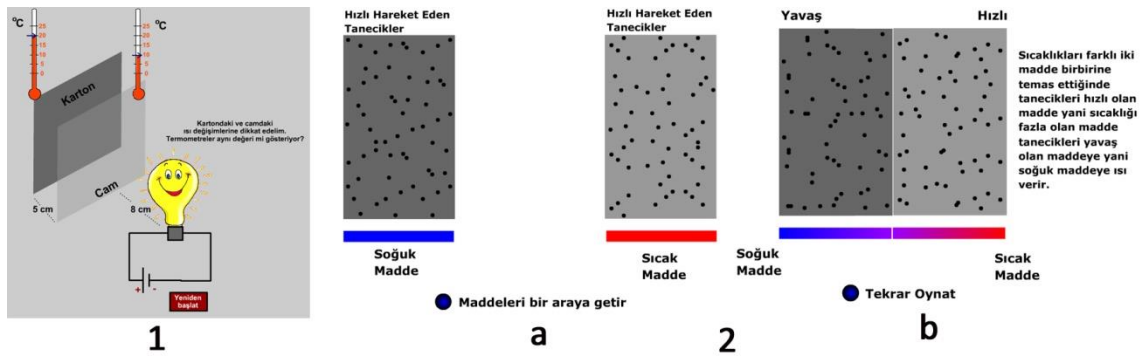


Figure 4. Sample activities for based on modelling

This web-assisted environment which allows the students to work individually can also be used by the teacher during face-to-face education. Especially while teaching abstract concepts, activities based on modeling will provide great convenience to the teacher. Within the classroom, the teacher will give the students a chance to discuss the subject by making them watch the activities while teaching the subject.

#### 4. Conclusion and Recommendations

Besides the effective characteristics of interactive teaching, it is also possible to meet situations which can be negative in terms of students. The student can need an effect that he/she may realize a misconception or the consequences this misconception during self-learning. Under such a circumstance, web-assisted content that is presented only based on modeling may not be effective. Web-assisted measuring and assessment is important in solving the problems that may arise. Web-assisted alternative measuring and assessment dimension, which is one of the effective sides of this study, has characteristics which may guide the students in such circumstances. It is thought that using such activities in blended learning studies will be useful.

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When students' individual differences are taken into consideration, they may need more time or examples under some circumstances. In such circumstances, when the limited hours of classes are considered, only face-to-face education in the classroom cannot meet students' individual needs. Presenting students with individual studying environments outside the classroom will give them an important opportunity for such needs. Positive attitudes of students towards technology are an important detail in designing such environments. Blended learning environments which are prepared based on web-assisted modeling come to the forefront at this point. While designing blended learning environments, when the dimension of teaching and learning are considered, features which may prevent students from misunderstanding should be paid attention to. That is, students' misconceptions or lack of knowledge can be measured by their answers to the questions. When such an assessment is made, the student can immediately be directed to the related activity and made to cover this lack. Our study, which was prepared by taking such needs and situations into consideration, comes to the forefront with its web-assisted teaching and measuring dimension.

Activities based on modeling which were prepared for this study can also be used by the teacher during face-to-face education within the classroom. When the advantages of face-to-face education in the classroom and web-assisted teaching are assessed together, the design of such environments becomes more important. While this study is intended for science lesson, it can also be applied to all other disciplines.

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