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Designing teaching materials for the use of alternative measurement and assessment activities in flipped classroom system

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Abstract

It is thought that creating an environment which enables the active use of students during the "Human Beings and Environment Relationships" unit which includes web-assisted alternative measurement and assessment activities will be effective. When the teaching dimension of alternative measurement and assessment activities are considered besides their measurement dimension, the application of such an environment in a web-assisted way increases the importance of the designed material. Based on the outcomes of "Human Beings and Environment Relationships" unit, this study which includes web-assisted conceptual maps, structured grids, word association, componential analysis and outcome based measurement and assessment activities used ASSURE teaching design model. The purpose of this study is to design teaching environments organized within the basis of web-assisted alternative measurement and assessment activities for the "Human Beings and Environment Relationships" unit to be used in flipped classroom system.

Keywords: Alternative measurement and assessment; web supported science teaching; flipped classroom.

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1. Introduction

Web-assisted materials developed for use in Science lessons enable students to learn more in learning by doing when compared with classical materials. The widespread use of technology in education causes positive contributions in teaching and learning to increase rapidly. This situation causes the emergence of new approaches about teaching and learning. Flipped classroom system comes to the forefront in such a process. In flipped classroom system, students have the chance to learn theoretical knowledge extracurricularly and to apply what they learn at school within the classroom. A classroom environment is created in which the teachers help actively in the classroom and in which individual or group problem solving activities take place (Butt, 2014). In such environments, an integrated structure is required which helps the students learn the theoretical part of the lesson by themselves rather than just creating a simulation-oriented structure.

Including alternative measurement and assessment activities which do not only measure but also teach will be useful while creating such environments. There are a great number of studies which show that using such activities do not only serve measurement purposes, but also make great contributions to students' learning the subjects and concepts in a meaningful, permanent and conceptual way in science lessons (Stears & Gopal, 2010). Based on the process, using alternative measurement and assessment activities which take into consideration individual differences that are compatible with constructivist learning theory has become a preferable approach (Cepni & Coruhlu, 2010).

In learning environments in schools, it is possible to face limitations such as students' individual differences and their learning span. Students, who can reach the learning content whenever they want and as much as they want outside the school, will have the opportunity to do more activities with teacher support within the class environment. This situation will help students in overcoming the difficulties they face (Torun & Dargut, 2015). In building their theoretical background, students can use web-assisted alternative measurement and assessment activities individually while these activities can also be used by the teacher in classroom activities (Cetinkaya, 2015).

Using flipped classroom technique based on web-assisted alternative measurement and assessment activities for the "Human and Environment Interaction" unit of science lesson was decided. The purpose of environment education is to teach the individual to recognize the natural environment he lives in and to teach him how to use natural resources in an efficient and balanced way. Rapid extinction of natural resources and unconscious destruction of natural living environments by people have begun to be seen as important problems. Accordingly, when the rapid increase of environmental problems and the fact that these problems can reach irreversible points in the future are considered, human and environment interaction becomes very important (Demir & Yalcın, 2014).

The purpose of this study is to design teaching environments organized within the basis of web-assisted alternative measurement and assessment activities for the "Human Beings and Environment Relationships" unit to be used in flipped classroom system. Based on the outcomes of "Human Beings and Environment Relationships" unit, this study which includes web-assisted conceptual maps, structured grids, word association, componential analysis and outcome based measurement and assessment activities used ASSURE teaching design model.

2. Method

The opportunities provided by technology should be used during instruction with a systematic planning. One of the models that can be used to make such a planning is ASSURE instructional design model. ASSURE model is the acronym of the six stages that make up the model. These stages are analyze learners, state objectives, select media and materials, utilize media and materials, require learner participation and evaluate and revise. With learner analysis, the most suitable method and material selection should be decided upon (Russell, 1994; Uysal & Gurcan, 2004). This study includes

the principles and strategies of the constructivist learning method in designing web-assisted activities and used ASSURE instructional design model.

3. Teaching material design

The target population of our study is secondary school 7the graders. The stages followed for the design of web-assisted alternative measurement and assessment activities based on Assure instructional design are given below.

- **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 "A trip to the world of organisms" unit at 3rd grade and "Let's learn about the world of organisms" 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 4 objectives in "Human and environment interaction" unit, 1 for the subject of "Ecosystems" and 3 for the subject of "Bio-diversity" (Table 1).

Table 1. Number of Objectives and Subjects/Concepts of Human and environment interaction Unit

Unit subjects	Number of Objectives	Recommended hours of class	Subject/ Concepts
Ecosystems	1	4	Species, habitat, population
Bio-diversity	3	6	Solid fuels, liquid fuels, gas fuels

- **Select Methods, media and materials**

When the factors of number of students 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 "showing" and "telling" teaching methods.

- **Utilize Media and materials**

It was ensured that the activities in the prepared material could be used individually. In individual use, web-assisted activities can be made for each objective. In classroom use, the teacher will be able to utilize projector or smart board.

- **Required learner participation**

In an environment where students will actively participate, individual study, team work, question and answer method and web-assisted teaching will be used. Students will be able to use the prepared material both at home and with the participation of the whole class in the classroom guided by the teacher.

- **Evaluate and revise**

In order to evaluate students' objectives, activity based measurement and assessment material will be used (Cetinkaya & Tas, 2016). In this material, there are expressions in the form of statements for the objectives of "Human and environment interaction". The students are expected to answer these expressions as "agree" or "disagree". The student moves on to the statement prepared for the next objective when he/she answers the questions correctly. When the answer given by the student is not correct, the student is expected to answer again to a different question that belongs to the same objective. When the student answers incorrectly again, the student is directed to the activity of the objective thinking that he/she lacks information. After the student completes the activity he/she can repeat as many times as he/she wants, the student is directed to expressions presented as statement. The student continues with the statement prepared for the next objective and this is repeated for all objectives. While the program reports the results to the students, the results are also sent to the teacher of the lesson by e-mail.

3.1. Alternative measurement and assessment activities used

Web-assisted alternative measurement and assessment activities developed for this study are concept maps, structured grids, word association, componential analysis table and objective based measurement and assessment. The preparation of these activities and one example for each are presented below.

3.1.1 Concept maps

These are graphical tools which are used to organize and represent information. They depend on associations between concepts which are stated by a connection that ties two concepts together. Concept maps are used to enable students to learn new information by using old information and making associations between the old and new information (Novak & Canas, 2008). So long as they are formed correctly, they can be used by teachers and students in every step of instruction. Concept maps can be developed with the participation of students in all classroom activities or group activities (Ayas, 2014). Figure 1 gives a sample of web-assisted concept map developed for the unit of Human and environment.

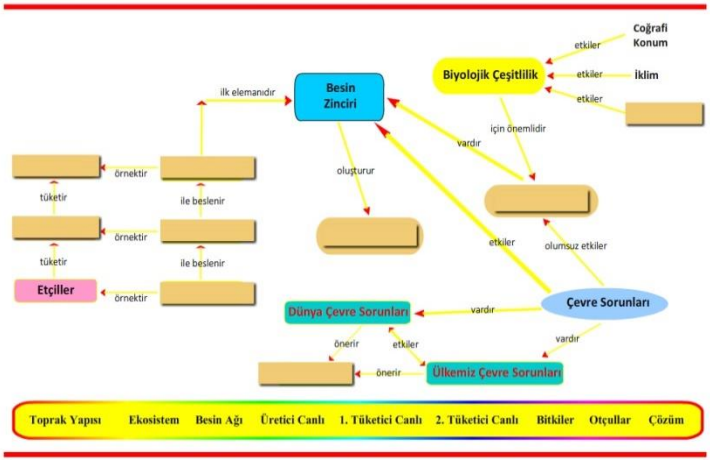

Figure 1. A web-assisted concept map

Figure 1 presents a web-assisted concept map example. Students are expected to drag the concepts under the map to suitable places. The concept dragged correctly is placed with a warning of "correct". The concept which is dragged incorrectly cannot be placed and goes back to the space under the map with the warning "incorrect, try again".

3.1.2. Structured grids

This is a technique used to find out students' misconceptions and to find out their shortcomings inlearning (Bahar et al., 2006). When this technique is being applied, a table consisting of 9 boxes are prepared based on age and level. The concepts, pictures, numbers and definitions about the subject are placed randomly in boxes. The students are asked different questions about the subject and they are asked to find the suitable box for the answer of each question. In some questions, they are asked to order the numbers of boxes logically or functionally (Cetinkaya, 2015). When the student chooses the wrong box, incorrect or missing information about the subject comes to light (Cepni, 2009).

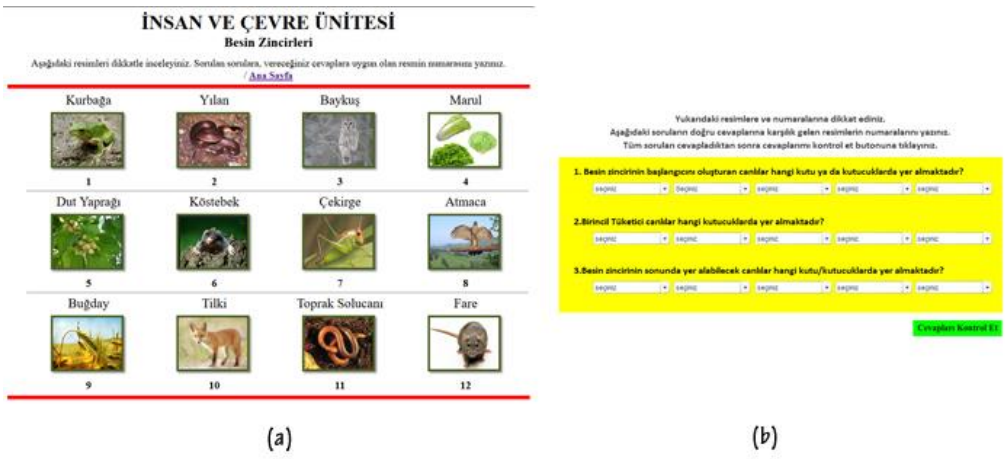

Figure 2. Web-assisted structured grid example

Figure 2 gives a web-assisted structured grid example. There are pictures, names and numbers on the left (a). Some questions are asked on the right (b). The correct box opened under the questions requires the student to choose the number and name of the picture on the left. The student who completes the processes for all questions presses the button "check my answers" and sees the correct answers on the screen with his answers and makes a comparison.

3.1.3. Word association

Word association is a method directly related with understanding a person's concept groups. This technique helps to determine the associations the student forms in his cognitive structure and to determine the construct in long term memory (Ozsevgec, 2008). Web-assisted word association developed for this study can be seen in Figure 3.

Figure 3. Web-assisted word association example

3.1.4. Meaning-analysis table

Meaning-analysis table (MAT) is a table developed two dimensionally for the classification of the characteristics of entities or objects (Figure 4). In one dimension of the table, there are the entities or objects the characteristics of which will be solved, in the other dimension, there are the characteristics. MATs can be used effectively in learning the discriminating characteristics of concepts (Ayas, 2014).

Figure 4. Web-assisted meaning analysis table

Figure 4 gives a web-assisted MAT. In one dimension, there are some concepts and in the other dimension there are the characteristics of these concepts. Some places are left blank and the expressions to be placed in these blanks are listed below. Students try to drag the correct expression to the correct place. When the students try to drag to the wrong place, the expressions go back to their places below with the warning “incorrect”. When they drag correctly, the expressions are placed with the warning “correct”.

4. Conclusion and recommendations

In flipped classroom method in which students take active role in their individual learning, it is important to present the theoretical background about the subject to be taught systematically in a planned way. Situations which are difficult to be fixed in the future may arise when students misunderstand or not realize that they learn incompletely in environments video lessons or animation-like applications are presented. When assessment and instruction are considered, using alternative measurement and assessment techniques will be the right choice for such environments. By using web-assisted alternative measurement and assessment techniques, mental confusions that may arise in students will be eliminated.

Web assisted alternative measurement and assessment, one of the main themes of this study, presents solutions to such problems. The designed material gives opportunities to students to try again when they answer incorrectly. This situation continues until they answer correctly. In addition, the student can see his own answer and the correct answer simultaneously on the screen and can make comparisons. Materials guide the students who are trying to form their theoretical background individually. In addition, equality of opportunity is ensured for learning arising from individual differences in terms of the need for more time and need to repeat. With the pre information formed thus, opportunities are presented for more activities in the classroom and for students to question what they have learned. In getting useful results in our web-assisted material preparation study, the teacher’s performance in the classroom is also an important factor. The teacher’s use of web-assisted alternative measurement and assessment techniques in classical or computer environment and during face-to-face instruction will give the students the chance to question their previous learning.

This study can be prepared and presented for the other subjects in science lesson. It can also be designed and measured for other disciplines and it can be developed by researchers to create web-assisted environment in flipped classroom method.

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