

Designing and Applying Web Assisted Activities to be Used in Flipped Classroom Model

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ABSTRACT

The purpose of this study is to develop personalized web assisted activities for the flipped classroom model applied in the “Human and Environment Interactions” unit of science lesson and to research its effect on students’ achievement. The study was conducted with the 74 participation of 7th grade science lesson students within a period of three weeks. In the study, one of the experimental research methods, quasi-experimental research method, was used. Two different classes were randomly assigned as the experimental and control groups and flipped classroom model was applied on both groups. In the control group, only video lessons were used before the lesson. In the experimental group, web assisted activities were used as well as video lessons both before and during the lessons. “Human and Environment Interactions Unit Achievement Test”, which had a reliability coefficient of (KR-20) 0.76, was applied on the groups. The data analyses showed that there was a positive significant difference in favor of experimental group students. The developed material developed can be re-organized for any subject of the science class.

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1. INTRODUCTION

The widespread use of technology in education causes the emergence of new approaches about science teaching and learning. Web-assisted materials developed for use in Science lessons enable students to learn more in learning by doing when compared with classical materials. In web-assisted education, materials should be prepared according to web criteria and the content should be enriched with visual elements in order to increase students’ interest in the material. In such materials, contents which use vocal and animated elements are preferred by students [1],[2]. For high level efficiency, web-assisted materials should be designed based on students’ needs and preferences and the content should be enriched with informative and interesting animations [3]-[5]. Studies conducted have reported that using web-assisted materials makes important contributions to students’ learning scientific concepts in a meaningful, permanent and effective way [3],[4],[6],[7].

Considering the positive reflections of using web-assisted teaching, using contents such as video and documents will be useful while presenting the theoretical information about the lesson to students. Flipped classroom system comes to the forefront in such a process. Flipped classroom management is defined in literature with various names such as “flipping classroom”, “flipped classroom”, “flipped learning”, “reversed instruction”, and “inverted classroom”. Different from traditional teaching, a method which flips lecture and theoretical information is used. In this teaching approach, students learn theoretical information before lesson and thus students are given the chance to study more collaboratively inside the classroom [8].

While using this method, the content of the lesson is generally told in a video and presented to students. Students who learn the theoretical information by watching these videos do activities in the classroom guided by the teacher [9]. In flipped classroom system, students have the opportunity to learn theoretical information by themselves outside classroom hours and to apply what they have learned in classroom environment.

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 [10]-[13]. It is known that the evaluation activities in our country have been based on Bloom's complete learning theory and taxonomy for years. In such assessment and evaluations, the focus is not on the process, but on the result. In such an approach, students' abilities and development potentials are generally not taken into consideration. However, education programs recently developed in the world and in our country are generally based on theories and approaches such as structuralist theory, multiple intelligence theory, problem solving approach, Project-based learning and developing scientific process skills. These new approaches have made it compulsory to use new assessment and evaluation techniques [14]. 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 [11]-[13],[15].

In learning environments in schools, it is possible to face limitations such as students' individual differences and their learning span. One of the greatest advantages of 'Flipped classroom' is the fact that it presents students learning environments suitable for their individual pace independent from time and space [16]. Students who can reach learning content which includes web-assisted alternative assessment and evaluation activities outside the classroom whenever and wherever they want will have the opportunity to do more activities with the support of the teacher inside the classroom environment. This situation will help students in overcoming the difficulties they face [17]. 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 [18].

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 [19]. The purpose of this study is to develop personalized web assisted activities for the flipped classroom model applied in the "Human and Environment Interactions" unit of science lesson and to research its effect on students' achievement.

2. RESEARCH METHOD

The study was conducted with the participation of 7th grade science lesson students (N=74). In this study, quasi-experimental research method, one of the experimental research methods, was used. Two different classes with the same learning level were randomly assigned as the experimental and control groups. "Human and Environment Interactions Unit Achievement Test" was applied on both the experimental and the control group before and after the study. The reliability coefficient of the achievement test was (KR-20) 0.76. The data obtained were analyzed with independent groups t test by using "SPSS 17" program. In addition, semi-structured observations conducted by the researcher were used to test the consistency of the quantitative data and to get information about the process.

On the basis of the attainments of "Human and Environment Interactions" unit, the study which contained concept maps prepared as web-assisted, structured grids, word association, component analysis tables and attainment based assessment activities was applied on the experimental group students for a period of 3 weeks (10 hours). Besides theoretical information presented with video before the lesson, personalized activity based materials were used. In addition, the activities inside the material were also used by the teacher during the lesson. Assure Instructional Design model was used to design the prepared material. 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 [20]-[21].

This study includes the principles and strategies of the constructivist learning method in designing web-assisted activities and used Assure instructional design model.

2.1. Instructional Material Design

Shown below is the study plan for the class in which the material developed based on web-assisted activities will be used (Figure 1). The material is used for pre-class individual studies, and also as an alternative after-class measurement and evaluation tool.

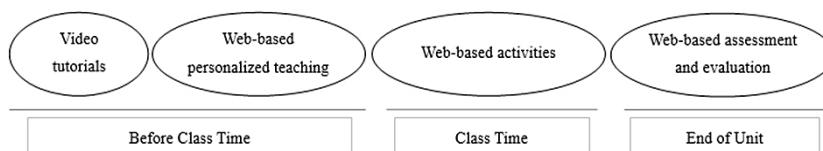


Figure 1. Planned process concerning "relations between humans and the environment" unit

The Figure 1 shows the planned process concerning the use of the material. The plan is to have the students use the instructional material before class, in addition to watching video lectures. After learning the theoretical information before class, the students will be asked to conduct cooperative learning activities in the classroom. During the in-classroom learning process, the activities described in the material prepared by the teacher can be used. Once the subject unit is completed, the students will assess themselves by using the alternative web-assisted measurement and evaluation material. In addition, a quiz will also be performed by the teacher.

The preparation stages of the web-assisted materials, which were organized according to the Assure Instructional design method, are given below. Assure model is named by using the initials of the six stages that make up the model (Figure 2).

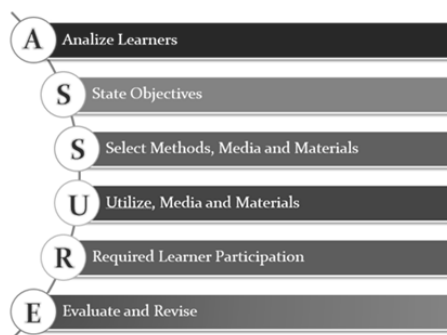


Figure 2. Assure instructional design model

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

i) Analyze learners

General characteristics: Between 11 and 12 years of age, a class size of between 25 and 30, formal operational stage; can do mental processes such as deduction and induction, thinks with symbols and can make generalizations.

Input skills: 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, positive attitude towards science lessons.

Learning Styles: Visual, verbal mixed, kinesthetic.

ii) 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

iii) 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.

iv) 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.

v) 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.

vi) Evaluate and revise

In order to evaluate students' objectives, activity based measurement and assessment material will be used [22]. 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.

2.2. 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.

i) 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 [23]. 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 [24]. Figure 3 gives a sample of web-assisted concept map developed for the unit of Human and environment.

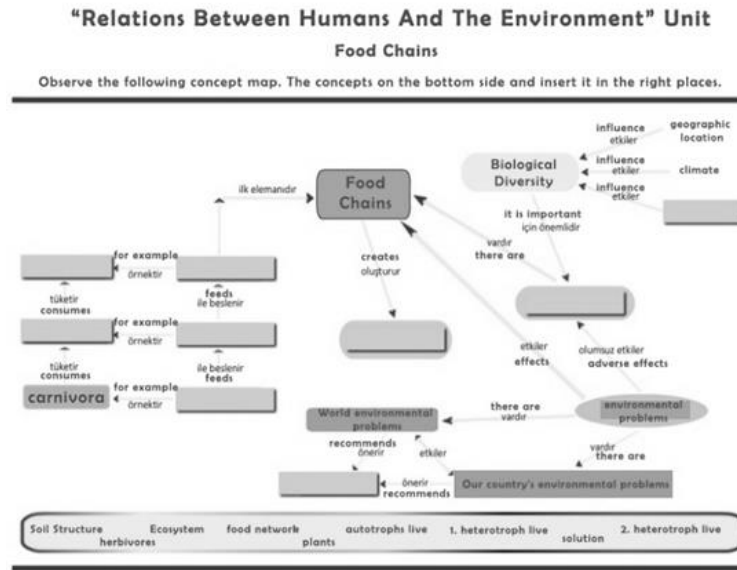


Figure 3. A web-assisted concept map













Figure 3 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”.

ii) Structured grids

This is a technique used to find out students’ misconceptions and to find out their shortcomings in learning [25]. 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 [18]. When the student chooses the wrong box, incorrect or missing information about the subject comes to light [3].

"Relations Between Humans And The Environment" Unit
Food Chain

Carefully review the pictures below. Write the number of the appropriate picture for questions.

 1	 2	 3	 4
 5	 6	 7	 8
 9	 10	 11	 12

(a)

look carefully at the pictures and the numbers.
please answer the following questions accordingly.

1. Besin zincinin bağlanmasını oluşturan canlılar hangi kutu ya da kutucuklarda yer almaktadır?

2. Birinci Tüketiciler hangi kutucuklarda yer almaktadır?

3. Besin zincirinin sonunda yer alabilecek canlılar hangi kutu/kutucuklarda yer almaktadır?

(b)

Figure 4. Web-assisted structured grid example

Figure 4 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.

iii) 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 [26]. Web-assisted word association developed for this study can be seen in Figure 5.

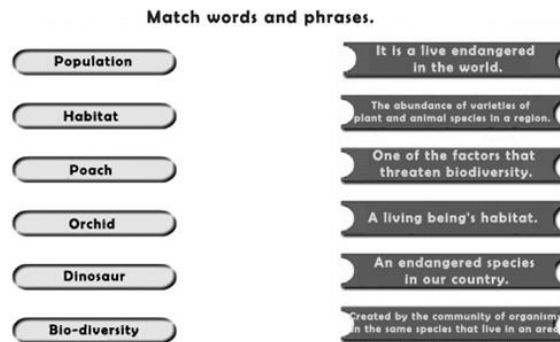


Figure 5. Web-assisted word association example

Jumbled words are expected to be dragged and matched correctly. In case of mismatch, match does not occur with the warning “incorrect” and the words go back to their old places.

iv) Meaning-analysis table

Meaning-analysis table (MAT) is a table developed two dimensionally for the classification of the characteristics of entities or objects (Figure 6). 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 [24].

Drag the appropriate statements of the space.

the kinds	Climate Features			
	Hot Weather	Cold Weather	Rainy Climates	Temperate
Aquatic Ecosystem				
Forest Ecosystem				
Terrestrial Ecosystem				

Protozoa Grassland Desert Marshy Ground Stream River

Figure 6. Web-assisted meaning analysis table

Figure 6 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”.

The materials prepared were presented to students in the form of a website. Adobe dreamweaver cs6 program was used to organize the web page (Figure 7).

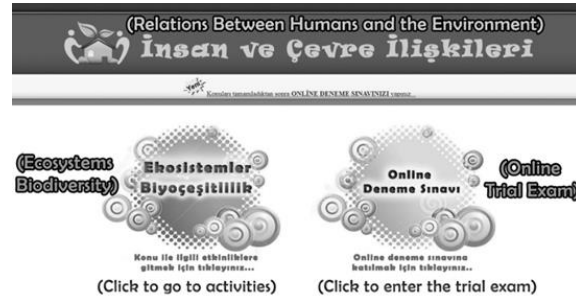


Figure 7. The introduction image of the material prepared for the human and the environment unit.

3. RESULTS AND ANALYSIS

The pre-test and post-test results of the academic achievement test prepared for the unit of “Matter and Heat” and their distributions in the experimental and control group were examined. Pre-test and post-test average scores of the experimental and control group are below (Figure 8).

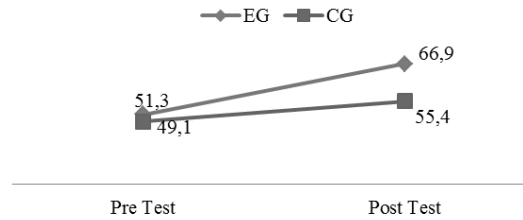


Figure 8. Comparison of pre-test and post-test results of the experimental and the control group

It can be seen from Figure 8 that both groups had similar pre-test results. It can be seen in post-test results that although both groups had increased scores, the experimental group showed higher increase. The pre-test achievement average of the experimental group students was 51.3, while their post-test achievement average was 66.9. The pre-test achievement average of the control group students was 49.1, while their post-test achievement average was 55.4. Both groups were found to have increased achievement scores at the end of the application. In order to analyze whether this increase was significant, t test analysis of the pre-test and post-test scores of groups was conducted (Table 2).

Table 2. T test analysis results of pre-test and post-test results of the experimental and the control group

Groups	Tests	N	Averages	Standard Deviation	t-test results	Significance
EG	Pre Test	37	51.3493	16.49306	-4.674	.000*
	Post Test	37	66.8892	11.70029		
CG	Pre Test	37	49.0971	13.14394	-1.740	.086
	Post Test	37	55.4032	17.70054		

* $p < .05$

When Table 2 is examined, it can be seen that there was a statistically significant difference between the pre-test and post-test results of the experimental group students ($t(74) = 4.674$; $p < 0.05$). In control group students, no statistically significant difference was found between the pre-test and post-test results ($t(74) = 1.740$; $p > 0.05$). t test analysis of pre-test and post-test results of the groups are as follows.

When Table 3 is examined, it can be seen that there is no statistically significant difference between the pre-test results of the experimental and the control groups and that both groups had similar results before the application ($t(74) = 650$, $p > 0.05$). In the comparison of post-test results, a significant difference was found in favor of the experimental group ($t(74) = 3.293$, $p < 0.05$).

Table 3. T test analysis of pre-test and post-test results between the experimental and the control groups

Tests	Groups	N	Averages	Standard Deviation	t-test results	Significance
Pre Test	EG	37	51.3493	16.49306	-.650	.518
	CG	37	49.0971	13.14394		
Post Test	EG	37	66.8892	11.70029	-3.293	.002*
	CG	37	55.4032	17.70054		

* p < .05

4. DISCUSSION

The most valuable times in the classroom are spent conveying theoretical information. This involves an entirely passive and unidirectional learning process. Due to the time spent on conveying theoretical information, only a limited amount of time can be allocated to in-class student activities [27]. However, students tend to exhibit higher academic performance in classes where cooperative learning activities are conducted [28]. To be able to allocate more classroom time to cooperative learning activities, the time spent on conveying theoretical information should be reduced, and even minimized. This is where the Flipped Classroom Model becomes important [27]. By having theoretical learning take place before the classroom time, teachers are able to invest more time during class in various techniques such as research-based learning, active learning, peer learning and cooperative learning. Such techniques not only augment the students' interest in the class, but also help improve their high-level thinking skills. This provides an important advantage, especially for crowded classes [29].

Studies conducted frequently address the necessity of creating materials that will contribute to individual learning of students. Web assisted alternative assessment and evaluation activities were prepared to help the students in learning the theoretical information of the lesson individually. The most important reason for preferring web assisted alternative assessment and evaluation activities were the fact that it contained both assessment and teaching characteristics at the same time. Opportunities are given for students to be aware of the theoretical information. Too much time is spent to teach theoretical information during class. Flipped classroom model gives advantages at this point.

Allowing sufficient time for in-class activities also contributes positively to the creative thinking skills of students. However, this process might be less positive for students who did not gain a sufficient understanding of the theoretical information in the pre-classroom phase. The development of such skills is associated with the level of preparation before class. Therefore, there is a need to develop e-learning tools that will support the individual learning of students [30]. Web assisted activities used in this study were used by the teacher during the lesson in addition to being used before lesson when theoretical information is learned.

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 assessment and evaluation techniques besides video like visuals that can be used for the theoretical background of the lesson, mental confusions that students may experience can be solved.

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.

Rapid advances in technology, as well as students' ever-growing interest in them, have increased the importance using of technology in education. To be able to make effective use of technology for educational purposes, there is a need for instructional materials that will help guide students. Technology-assisted instructional materials must be prepared based on a systematic planning. The present study focuses on the planning processes that are necessary during the preparation of web-assisted instructional materials. One of

the most effective models that can be applied to preparation of web-assisted instructional materials is the Assure Instructional Design Model. The study involves the application of such planning to the flipped classroom model. As part of this planning, materials were prepared in order to assist and enhance the individual learning of students in pre-class phase of the flipped classroom model, which is the phase where the theoretical information is learned. Alternative measurement and evaluation activities were included into the contents of these materials. The assessment-related and instructional features of these alternative measurement and evaluation materials were also considered when selecting these activities. We consider that use of interactive instructional materials along with the most frequently used method of the flipped classroom model (i.e. the use of the video lecture method, according to the literature) will prove to be an effective approach. This material provides significant advantages that the students can benefit from, since it allows the student to use the material according to his/her own individual learning speed. These advantages include: allowing students the opportunity to repeat activities as much as they need, and directing students towards various activities based on the wrong answers they give during the Q&A measurement and evaluation.

The activities suggested in the present study can be utilized and improved by researchers conducting new studies on the flipped classroom model. The materials developed in the present study can also be re-arranged/modified for use in other subjects of science classes. It can also be designed and measured for other disciplines and it can be developed by researchers to create web-assisted environment using flipped classroom method.

5. CONCLUSION

This study researched the effects of web assisted activities in classrooms using flipped classroom method on the individual study and thus achievements of the students. Pre-test results of the learning levels of experimental and control groups were found to be similar ($t(74)= 650, p>0.05$). Post-test results analysis showed a positive significant difference in favor of the experimental group students ($t(74)= 3.293, p<0.05$). Based on these results, it can be said that experimental group students are more successful in learning theoretical information individually. The contributive characteristic of web assisted activities in individual learning comes to the forefront in this success. This situation is also expressed in the semi-structured classroom observations of the researcher. While experimental group students did not need too much support about theoretical information, the teacher sometimes needed to give theoretical information in control group students.

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