

# The Use Of Building Models As An Educational Material And Their Impact On Learning

Ahmet C. APAY

Department of Construction, Sakarya University,  
Adapazari, Turkey,  
aapay@sakarya.edu.tr

Emine AYDIN

Department of Construction, Sakarya University,  
Adapazari, Turkey,  
emineb@sakarya.edu.tr

Tahir AKGUL

Department of Construction, Sakarya University,  
Adapazari, Turkey,  
tagul@sakarya.edu.tr

Ali GURBUZ

k.aligurbuz@gmail.com

**Abstract:** Materials are an indispensable component of education and teaching and used for supporting teaching during the teaching-learning process. Aids and materials are employed in an attempt to fulfill the objectives of the teaching process during education-teaching activities. In today's rapidly-changing and developing world, individuals are not supposed to obtain information from one single source and memorize it; in contrast, the objective is to school the type of individuals who can know how to access to information, how to use it and how to come up with ways to overcome problems encountered. The use of teaching materials designed in accordance with the principles of teaching technologies is vitally important for enabling individuals to develop such skills. A fundamental factor in increasing the level of achievement in courses, in ensuring a decent educational system and in enabling students to experience an enduring learning process is to get students to like the subject to be taught. Otherwise, students will not be interested enough to get the input and no enduring learning process will take place no matter how well-versed and experienced an instructor is in his/her field. This paper is a study into the effects of the use of educational materials on the level of students' achievement and interest in courses. Furthermore, it includes a comparison between the efficiency of material-aided instruction and teacher-centered instruction. The effect of these two methods on the level at which particular concepts related to a lesson are learned has been analyzed through the use of experimental design with pretest-posttest control group.

**Keywords:** Building models, education and teaching, educational materials

## 1. Introduction

As a term the model denotes to doing a smaller or bigger copy of an object in a determined scale. Today the model usage is widespread in many fields. The models to examine human body used in biology and medicine, the earth model which is a minimized copy of the Earth used in geography, in machine sector the models with changing scales from  $\frac{1}{2}$  to  $\frac{1}{25}$  according to their dimensions and details, earthquake models, dynamic models showing the flow of a stream, military models, ship models, car models, airplane models, architectural models, training models, topographic models, terrain models, urban models, park-garden models, people models, building models, interior models, and etc can be given as examples. In terms of building education, the term of model brings "architectural models" such as topographic, building, furnished building interior into mind.

Material use in education is a rapidly spreading application in permanently developing and renewing Turkish education system. Oral narrative technique centred and teacher-centred education model which are implemented widely until recently has started to loose its validity today. Oral narrative technique should be implemented with other education methods and supported with other materials in the education place. [1]

## 2. The Importance of Material Use in Education

Materials are indispensable parts of education and training in our age. In order to realize educational objectives, equipment and materials are used in all of education and training studies. Artificial and natural substances are named as material when they serve for a virtual or actual purpose. When it is associated with education “education material” is named as “course material” and it defines all of the living, non-living, practical and theoretical information and affluences regarding to that course. The conception of material includes virtual, actual, artificial and natural data or affluences which serve for a purpose. [2]

Material is an efficient education tool. It is possible to define the education tool as an environment to provide information sharing between a communication channel (teacher) and receivers (students) [3]. In today’s rapidly changing and developing world, it is not expected that individuals to obtain the information from one source and memorize this information, on the contrary it is intended to raise individuals who know ways to achieve information, who use them and when faced with a problem who can create solution methods by using that information. The use of education material which is prepared in accordance with the principles of the education technologies has significance for teachers to design an active and interactive learning environment which is necessary for individuals to acquire these above features. [4]

### 3. Using Building Model As An Education Material

Department of Building Education is a department that theoretical and applied courses are taught together. In theoretical courses in order to be helpful for the correlation with applied courses and in order to develop the three dimensional thinking abilities of students, the building model is preferred as the material in this research. The achievement and attitudes of students toward Technical Drawing are examined with the designed building model. Cross-sectioning of the building plan is one of the parts for students that they densely need to use three dimensional thinking powers. Through the expression via model technique it is expected that for students to develop their perception ability better and perform a more efficient learning. The research is conducted with 60 students in total, as 30 from control group and 30 from experiment group, who are chosen according to random sampling methodology among the 1<sup>st</sup> year students who take Technical Drawing course in 2008-2009 Spring semesters and from Department of Building Education at Sakarya University Faculty of Technical Education. In this research two different learning methods are applied randomly to these two categories. No information is given to students in experiment and control groups regarding whether they are in experiment or control group.

The application is done in the duration of “Cross-sectioning of a plan” which is specified in the Course Curriculum. In order to give the necessary information to students and to test their learning regarding to this course, a housing project which is constituted of the ground floor and a normal floor is prepared. Since some factors are thought such that the students meet with this issue as first time and the course hours are limited, the project is designed so simple. In order to teach the “Cross-sectioning of a plan” in a best way, two section lines are passed with “A-A Section” code on X axis of floor plans and with “B-B Section” code on Y axis of floor plans and it is given importance that the section lines to touch to the stairs, low floor, door-window frames (Figure 1).

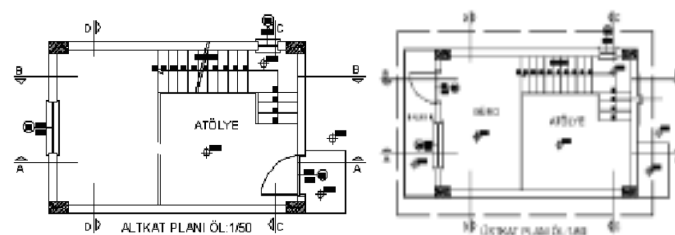


Figure 1. Floor Plans

#### 3.1. Preparation of the Model

To express the selected issue in a best way by the model it is planned to break into horizontal pieces from 2/3 length of the height of floor and vertical pieces from the places that the A-A and B-B section lines pass in order to show the floor plans as in the project (Figure2,3,4 and 5). Hence, in this way floor plans and section lines can be understood more clearly in terms of what they mean.



**Figure 2.** The First Floor of the Model



**Figure 3.** The First Normal Floor of the Model



**Figure 4.** The A-A Section View of Model



**Figure 5.** The B-B Section View of Model

A greater scale is selected compared to a standard scale and 1/20 scale is preferred in order to make all class to see the model during the course hour and more importantly to enable permanent learning which is our main objective.

### 3.2. Research Design

In this research it is attempted to determine the effects of Expression and Teaching Activity and Teacher-Centred Education Activity on students' success and students' attitudes toward Technical Drawing courses. For this purpose an experimental design which is suitable to "pre-test and post-test" model with control group is used.

Groups	Pre-test	Education Activity	Post-test
Control	AT AI	Teacher-centred Education Activity	AT AI
Experiment	AT AI	Model Aided Education Activity	AT AI

**Table 1.** Research Design with Pre-test/Post-test Control Group AT: Achievement Test, AI: Attitude Inventory

As seen on Table 1, the topic of "Cross-sectioning of a plan" of Technical Drawing Course is taught by Teacher-centred Education Activity for control group whereas it is taught by Model Aided Education Activity for experiment group. In the research, the effects of Teacher-centred Education Activity and Model Aided Education Activity are compared in terms of learning of "Cross-sectioning of a plan" of Technical Drawing Course. Before the application of two different education activities both for experiment and control groups the Achievement Test (AT) is applied firstly as pre-test to evaluate their pre-information level toward "Cross-sectioning of a plan" and then applied as post-test after courses of experiment and control groups. And again, in order to determine the pre-attitudes of students toward Technical Drawing Courses "Technical Drawing Attitude Inventory" is applied firstly as pre-test and then applied as post-test after courses of experiment and control groups before the application of two different education techniques both to experiment and control groups .

### 3.3. Variables of Research

#### 3.3.1. The Achievement Test

The Achievement Test (AT) is prepared under the control of field specialists. It is constituted of drawings and questions which are prepared according to the "Cross-sectioning of a plan" unit of the Technical Drawing Course Curriculum which is prepared by the Head of Department of Building Education at Sakarya University Faculty of Technical Education.

The Achievement Test is implemented two times for two groups in the form of pre-test and post-test as being before the education and after the education. Before the education activity the pre-test is applied in order to evaluate the pre-information level of students regarding to "Cross-sectioning of a plan" and after the education activity the post-test is applied to reveal the effect of these two different activities on students to learn this issue.

#### 3.3.2. Technical Drawing Attitude Inventory

Fivefold Likert-type attitude inventory (I strongly agree, I agree, I neither agree nor disagree, I don't agree, I strongly disagree) toward Technical Drawing which comprises of 12 items as being 6 of them positive and 6 of

them negative statements in order to determine the approaches of students toward the Technical Drawing Course. The scale results are evaluated by scoring the positive questions as “I strongly agree” (5 points), “I agree” (4 points), “I neither agree nor disagree” (3 points), “I don’t agree” (2 points), “I strongly disagree” (1 point) and the negative questions as “I strongly agree” (1 point), “I agree” (2 points), “I neither agree nor disagree” (3 points), “I don’t agree” (4 points), “I strongly disagree” (5 points). The pre-test before the education and the post-test after the education are implemented to the experiment and control groups of “Technical Drawing Attitude Inventory”. (Technical Drawing Attitude Inventory is given in Appendix-B).

### 3.4. Course Teaching for Control Group

The achievement test and attitude scales are applied as pre-test in order to determine students’ pre-information, skills and attitudes regarding to this issue. Teaching of this issue is started after one week. During the course oral narrative, written expression and question-answer methods are applied. The topic is transferred to students with the classical method as oral and written by using blackboards. The questions regarding to the incoherent parts are answered after lecturing and the lecture is ended with a last repetition. After the course “Technical Drawing Achievement Test” and “Technical Drawing Attitude Inventory” are applied as post-test and the results are recorded.

### 3.5. Course Teaching for Experiment Group

Before one week from the course the achievement test and attitude inventory pre-test applications are applied in order to determine the pre-information, skills and attitudes of students regarding to this topic as in the control group. The prepared model material is used actively during the course and showing the details regarding to this issue on the model as three dimensional become useful for students to animate plans and sections in their minds regarding to this issue. After course by preserving same conditions with control group The Achievement Test and The Attitude Inventory are applied as post-test and the results are recorded. The results of pre-test and post-test Achievement Test and Attitude Inventory for Experiment and Control Groups are given in APPENDIX C-F.

### 3.6. Data analysis

For independent groups the t-test is performed in SPSS 16.0 package programme in order to reveal whether there is a statistical difference among the experiment and control groups in terms of readiness regarding to this issue and attitudes toward courses such as Technical Drawing and occupational drawing. For dependent groups the t-test is performed in package programme in order to reveal the effect of two different education methods (Teacher-centred Education Activity and Model-Aided Education Activity) on success and attitudes toward “Technical Drawing Course, Cross-sectioning of a Plan”. One Factor Covariance Analysis (ANCOVA) is performed in order to compare the effects on learning of two different education activities after performing the educational activities and after bringing the pre-information and readiness level of students under control. ANCOVA is recommended in order to show the effectiveness of the applied experimental operation in experimental designs with pre-test and post-test control group. The ANCOVA test is defined as a “powerful technique which allows comparison among the groups by providing the statistically control of another variable or variables which are related to the dependent variable and named as common variable, besides the independent variable which is tested in a research to observe its effect.” [5].

### 3.7. Findings

The findings which are obtained through testing the data of experiment and control groups are given in this section. The hypothesis statements which are to evaluate changes in the points of achievement and attitude points of groups are tested with t-test by using SPSS 16.0 (Statistical Package for Social Sciences for Personal Computers) package programme. Arithmetic mean, standard deviation and t-test results for independent groups according to AT pre-test points, which is done to reveal the pre-information of experiment and control groups regarding to the issue of “Cross-sectioning of a plan” of Technical Drawing Course and to determine the difference between groups in terms of pre-information regarding to the specified topic, are summarized on Table 2.

Group	N	X	S.S	t	p
Experiment	30	18.50	11.08	1,014	0,315
Control	30	15.83	9.20		

N: Number of students, X: Arithmetic mean, S.S: standard deviation, t: tscore , p: significant coefficient

**Table 2.** Arithmetic mean, standard deviation and t-test results of groups according to AT pre-test points

On Table 2, according to AT pre-test results of experiment and control groups  $t=1,014$ ,  $p=0,315$  values are obtained. Since p-value is greater than the significance level of 0.05 there is no statistically significant difference between experiment and control groups in terms of pre-information regarding to the “Cross-sectioning of a plan” topic of Technical Drawing Course. Arithmetic mean, standard deviation and t-test results for independent groups which are obtained according to pre-test results are summarized on Table 3 with the aim of determining the attitudes of experiment and control groups toward the Technical Drawing Course before educational activity.

Group	N	X	S.S	t	p
Experiment	30	3,67	0,59	1,386	0,171
Control	30	3,37	0,83		

N: Number of students, X: Arithmetic mean, S.S: standard deviation, t: t score , p: significant coefficient

**Table 3.** Arithmetic mean, standard deviation and t-test results of groups which are obtained by Technical Drawing Course Attitude Inventory pre-test points

Arithmetic mean, standard deviation and t-test results, which are obtained according to the pre-test points of Attitude Inventory toward Technical Drawing Courses, are seen on Table 3. According to this,  $t=1,386$ ,  $p=0,171$  values are obtained from pre-test points of Attitude Inventory toward Technical Drawing courses of experiment and control groups. Since founded p-value is greater than the significance level of 0.05, there is no statistically significant difference between experiment and control groups in terms of their attitudes toward Technical Drawing course.

**Hypothesis- 1:** Hypothesis Sentence: The model-aided education activity has no effect on students to gain information and skills regarding to the issue of “Cross-sectioning of a plan” of Technical Drawing Course. In order to test the hypothesis the t-test is performed for dependent groups.

Test type	N	X	S.S	t	p
AT Pre-test	30	17,50	11,08	-13,160	0,000
AT Post-test	30	79,83	19,32		

N: Number of students, X: Arithmetic mean, S.S: standard deviation, t: t score , p: significant coefficient

**Table 4.** Arithmetic mean, standard deviation and t-test results of experiment group according to AT pre-test and post-test points

According to Table 4, the model-aided education activity has an effect on students to gain information and skills regarding to the issue of “Cross-sectioning of a plan” of Technical Drawing Course. A significant difference is found between the pre-test points and post-test points of experiment group with model-aided education activity.

**Hypothesis-2:** Hypothesis Sentence: Teacher-centred education activity does not have an effect on students in terms of gaining information and skill regarding to the topic of “Cross-sectioning from a plan” of Technical Drawing Course. In order to test the hypothesis the t-test is performed for dependent groups.

Test type	n	X	S.S	t	p
AT Pre-test	30	15,83	9,20	-13,521	0,000
AT Post-test	30	65,00	18,98		

N: Number of students, X: Arithmetic mean, S.S: Standard deviation, t: t score , p: significant coefficient

**Table 5.** Arithmetic mean, standard deviation and t-test results of control group according to AT pre-test and post-test points

According to Table 5 teacher-centred education activity has an effect on attainment of information and skills by students regarding to the topic of “Cross-sectioning of a plan” of Technical Drawing Course. A difference is found among the pre-test and post-test points of control groups with teacher-centred education activity.

**Hypothesis-3:** Hypothesis Sentence: There is no significant difference between the model-aided education technique and teacher-centred education activity for students in terms of gaining information and skills regarding to the topic of “Cross-sectioning of a plan” of Technical Drawing Course.

Group	N	X	S.S	F	p
Experiment	30	79,83	19,31	9,701	0,003
Control	30	65,00	18,98		

N: Number of students, X: Arithmetic mean, S.S: Standard deviation, F: analysis points , p: significant coefficient

**Table 6.** The covariance analysis results of experiment and control groups according to the AT post-test points

According to Table 6, when the AT pre-test results of students are brought under control, the following result is achieved that there is a significant difference between the teacher-centred education activity and model-aided education activity in terms of their effects on learning. According to AT post-test results, with their higher achievement average the difference is in favour of the experiment group.

**Hypothesis-4:**Hypothesis Sentence: “There is no statistically significant difference between the students educated with model-aided education activity and students educated with teacher-centred education activity in terms of attitudes toward Technical Drawing course after the education”.

Group	N	X	S.S	t	p
Experiment	30	3,89	0,53	-0,374	0,711
Control	30	3,83	0,64		

N: Number of students, X: Arithmetic mean, S.S: Standard deviation, t: t score , p: significant coefficient

**Table 7.** Arithmetic mean, standard deviation and t-test results of groups according to Technical Drawing Attitude Inventory post-test points

According to Table 7, there is a significance difference between the experiment and control groups in their attitudes toward Technical Drawing Course. According to this result, both model-aided education activity and teacher-centred education activity affect students in terms of developing positive attitudes toward Technical Drawing course. Although the difference between the average points of groups is not statistically significant, it is in favour of control group with model-aided education.

#### 4. Conclusion And Suggestions

In this research according to the t-test results of independent groups which is performed to evaluate the AT pre-test results of experiment and control groups, a statistically significant difference is not found in pre-information of experiment and control groups intended to the concepts regarding with the “Cross-sectioning of a plan”. In the Achievement Test post-test covariance analysis (ANCOVA) which is applied by controlling the pre-information regarding to the topic of “Cross-sectioning of a plan” of Technical Drawing course of experiment and control group, a significant difference is founded between the teacher-centred education and model-aided teaching activity. With higher achievement average in terms of the Achievement Test post-test results this difference is in favour of the experiment group. This result shows that the students that are educated with model-aided education activity are more successful than the students that are educated with the teacher-centred education activity. It is observed that students learn better and become more successful in the classroom where the model material is used.

According to the t-test results which are performed for independent groups as a result of the pre-test results of Technical Drawing Attitude Inventory, a statistically significant difference is not found in terms of pre-attitudes of experiment and control groups regarding to the Technical Drawing course.

According to the Attitude Inventory post-test results which are applied after two different education activities performed by controlling the pre-attitudes of students toward Technical Drawing course, a positive transformation is determined in the attitudes of students toward this course after both of these education techniques. A significant difference is not found by obtaining group averages as 3.83 and 3.89 for two groups according to the post-test results of attitude inventory. However, the average pre-test points of control group with the teacher-centred education techniques increases from 3.67 to 3.83 whereas the average of experiment group with model-aided education technique increases from 3.37 to 3.89. The increase rates in averages can be evaluated as in favour of the model-aided education activity.

Since models and other visual materials which are used in education and training meet the conditions of education by doing and living, they provide permanence and will be helpful to raise successful individuals.

## Reference

- BUYUKOZTURK, S. (2001). Pre-Experimental Designs finaltest Control Group Designs and data analysis, Pagem A data analysis, (pp. 1-3), Ankara, TURKEY.
- DEMİRKUŞ, N., (1999). “Fen Bilgisi Öğretim Yöntemleri ve Uygulamalarının Verimli Hale Getirilmesi”, Symposium on Teacher Education and Contemporary Perspectives, D.E.U. Buca Faculty of Education Journal Special Issue (11) (pp. 414-425), Izmir, TURKEY.
- DOĞDU, S., ARSLAN, Z., (1993). Applications of Educational Technology and Education Appliances, (pp.40), Ankara, , TURKEY.
- YALIN, H. İ., (2001). Instructional Technology and Material Development, Nobel publishing, (pp. 82), Ankara, TURKEY.
- ZAMAN, S. (2006). “Mitoz ve Mayoz Bölünme Konusunda Geliştirilen Bilgisayar Destekli Biyoloji Öğretim Materyalinin Değerlendirilmesi” KTÜ Science Institute, (pp. 129-131).