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## ARCHITECTURE AS AN EXTRACURRICULAR ACTIVITY FOR ELEMENTARY SCHOOL CHILDREN

### Abstract

The problems related to the man-made physical world cannot be resolved only by the education of architects. It is important to give environmental education at elementary level so that children can develop to be environmentally conscious adults responsible for the well being and development of the physical environment.

Awareness and responsibility for the man made physical environment, which should be the concern for all can be developed. Children create their own spaces and are concerned with the scale of the environment (Piaget 1997). It is important to find out whether they lose it at some stage and the reasons why people lose their concern for the environment. Research shows that if environmental education programs for children are designed and conducted in suitable environments, adults can also learn from them (Vaughan, Gack, Solorazano & Ray, 2003).

Education for the man made environment has been integrated into high school curriculum in some countries. Institute for Environmental Education, Architecture and City Planning in the United States developed a program for children. This program aimed to develop children's environmental awareness and a sense of belonging to the environment and society. Another program in New Haven, Connecticut aims to integrate architecture and mathematics. It intends to develop students' perception and understanding of the basic geometric shapes that are often used in architecture. Head Start School in New Mexico applies a different approach. Educators and architects design a three-dimensional book in this program where environment is considered as a tool for learning. There are programs in Sweden where children as users are influential in shaping their environment. In the USA California- based architectural firm opened a design competition for high school students to find new ways to view and appreciate their environment.

The purpose of the present study was to integrate architecture into the elementary education. A program consisting of design activities for elementary school age children was developed as part of a project integrating mathematics education and architecture. The implementation of the program at a "design club" as an extracurricular activity at a private elementary school was evaluated. A mathematics teacher working towards a graduate degree in mathematics education and an architect working towards a graduate degree in design implemented the program in cooperation. Data from the observations of the instructors as well as the participating children's work were evaluated. The results were promising for the development of such programs to be used to introduce the design profession to elementary school students as well as for increasing their awareness for the built environment.

**Key words:** *design education, elementary education, awareness for the physical environment, extracurricular activities, and environmental education*

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## Introduction

The built environment in Turkey has been in a state of transformation due to internal migration and population increase. Loss of the local and historic character of the cities have accelerated in planned and unplanned developments in line with the modernism. People's reaction to this transition can be defined as 'indifference'. Attributing this indifference to the environment with lack of education and, in order to transform this indifference into awareness, we proposed an education program on the built environment for elementary school children. By the application of this program we aimed to initiate a public effort by developing environmental awareness among elementary school students. The program was implemented in a private pilot school in Istanbul for a group of 10 students as an extracurricular activity 'design club'. A mathematics teacher working towards a graduate degree in mathematics education and an architect working a graduate degree in architectural design carried out the program in cooperation as advisors. The program was evaluated in accordance with the views and comments of the advisors and by the evaluation of the activities, students performed.

The history of civilization can be interpreted as the history of man shaping his environment. Formation of an architect as a person shaping the built environment has changed in time. Today, architect's responsibilities include the satisfaction of the user's physical, social and cultural requirements in the design of the built environment. Besides every responsible citizen has some kind of responsibility in the shaping of the built environment in which they are living.

Believing that awareness of and responsibility for the built environment, which should be the concern of all, can be developed through elementary education, we started a research.<sup>1</sup> Research on the environment aims at the improvement of the quality of life through design, planning and education. (Moore and others, 1985) It is important to offer preliminary teaching on the environment during the formal schooling stage in order to develop an awareness of the environment and consequently to get feedback on the shaping of the built environment from the users of that environment.

Children even in the early stages of their development are conscious about space and concerned with the scale of their environment. It is important to find out whether their awareness can be kept alive and further developed by education. Detecting the lack of programs to enhance their awareness in the education system, we proposed a program that aimed at emphasizing education on the built environment so that children could grow to be conscious adults responsible for the well-being and improvement of the built environment. We started this program with elementary school students because, research shows that if education programs for children are designed and conducted in suitable environments, parents and third-party adults can also learn from them (Vaughan and others, 2003).

There seems to be a neglect for the built environment in the education system. According to Roth, the amount of concern given to the perception and interpretation of the physical environment in which human beings live and work is far less than the concern given to the visual arts, music and dance in the education system of the Western world. (Roth, 1993). In comparison to the Turkish case, education on architecture has been integrated to some extent in the education system in the West.

Environmental awareness and education at public level are fairly new issues in Turkey. There are some non-governmental organizations whose emphasis is more on the natural environment and the issues addressed in environmental education in primary and high school education similarly consist mostly of pollution, energy and water conservation, waste management and reduction, population growth, global climate change, and the preservation of wild life and natural resources. Research on built environment has been conducted on an individual basis. A program for architectural seminars for high school students had been developed by the Union of Turkish Architects and the Ministry of Education. (Anon, 2004)

The existing high-school curriculum does not specify education on the built environment as a separate item. It contains courses that deal with topics related to education relating to the built environment but with a different emphasis. Mathematics, geometry, the social sciences and art courses contain topics related to architecture or the built environment but the application of these topics to real life and the built environment is limited. The inclusion of architectural education in school programs to form part of an extracurricular activity could be one way of introducing education on the built environment and opening the way to consciousness and awareness of issues such architecture and the city in Turkey.

### **Architectural Education in the School Curriculum**

Education on environment has been integrated into some high school curricula. There are many examples of environmental education programs intended to increase the children's awareness of the built environment by a combination of architecture and mathematics.<sup>2</sup> The effectiveness of the educational programs which integrate design, architecture and education indicate that environmental awareness can be created and learning can be more effective when students learn to look at and perceive their environment.

This study is part of a research carried out among a group of elementary students in Turkey for the development of an integrated mathematics and architecture program designed to assist in the development of elementary school students' awareness of the built environment. at the same time helping them for effective learning. The main concern of the program was to integrate architecture into the already existing mathematics curriculum without imposing an extra load on the curriculum. This study aimed at explaining the process of formation of an education program as an extracurricular activity, its results and relevance for environmental awareness.

### **Development of the 'Design Club' Program**

There are a number of interlocking topics between the elementary school curriculum and architecture. In this research we aimed to concentrate on mathematics and architecture emphasizing their close relation. In classical Greek and Roman times, architects were required to have a knowledge of mathematics. In the Byzantine Empire, the Emperor Justinian entrusted the building of Saint Sophia, a monument in Istanbul, to two mathematics professors, Isidoros and Anthemios. (Salingaros, 1999) Many architects in the past and present have stressed the importance of geometry in architecture in their writings. Vitruvius finds beauty in the architecture of a temple that should be based on the proportions of the human body. (Elam, 2001). The Parthenon in Athens is a good example of proportion in architecture. An analysis of the facade reveals the subdivisions of the golden rectangle. Le Corbusier (1986) in 'Towards a New Architecture' indicated his interest in geometrical structure and mathematics as "An inevitable element of Architecture. The necessity for order. The regulating line is a guaranty against willfulness. It brings satisfaction to the understanding." An analysis of the built environment from building to furniture shows the

relationship that exists between geometry and design. The Barcelona chair designed by Mies van der Rohe was based on the proportions of squares. The curvature of the back and legs show the relationship between the square and the circle. The relationship between geometry and architecture is important for a number of practical reasons and this relationship has also been a subject of concern throughout the architectural history in terms of aesthetics. In the modern period Euclidean geometry, particularly as regards platonic solids gave way to interpretations of fractal geometry . The relation between the two disciplines is strong and interdependent.

The goals of our program were to maintain or recall the relationship of mathematics and architecture as an extracurricular activity for elementary school children. The initial program thus developed was then evaluated. The program comprised of two steps: the development of the initial program and the application of the program in a selected school.

Our program was designed as a semester long program. Students that enrolled the design club met with their advisors once a week. The program was designed for situations in which students were actively involved in the teaching and learning process. They explored their ideas through drama, interacted with their environment, developed graphic communication skills and designed projects. We aimed to teach through the exercises, sketches or small projects. One of the main concerns was the simplicity of the program, which was designed in such a way that elementary school teachers who were not trained as architects should be able to implement the program with minimum training.

The program consisted of units that comprised of short explanations of the content followed by drama and/or activities/assignments to be performed by the students. These activities formed the core of the program. Issues included in the program were:

- Introduction to the terminology and principles of architecture and the scope of architectural profession and the man made physical environment.
- Relationship between human dimensions and the built world, furniture and objects and how architecture influences people and their way of living.
- Introduction to architectural presentation techniques/projections to develop students' skills in representing students' ideas on design and architecture graphically.
- Geometric analysis of the built environment to develop students' skills in analyzing the environment
- Mathematics/Architecture/Aesthetics to develop their skills for a critical look at their environment

We intended to introduce students to the basics of architecture and the built environment with the help of four activities, one of which was a drama to be performed by the students. By the completion of this activity, students got familiar with issues of architecture, learned about responsibilities of an architect as a professional. During the activity, students were able to express and discuss their ideas, thoughts and knowledge about architecture. There was a written text on the subject and improvisations were also encouraged while performing the drama, which provided a medium for learning and thinking about architecture. We planned to evaluate students' level of awareness of the built environment in terms of the buildings and squares (interior and exterior spaces) in their hometown in the second activity of this unit. The questions included well known buildings and places in the city. Students were asked to explain what they knew about these places. Through this activity we aimed to encourage students to learn about their built environment 'i.e.' the city of Istanbul. With this activity we also intended to discover what and how much they knew about the city they lived in. The

third activity was prepared to evaluate students' awareness of form and function. We presented building photographs from and outside of Turkey to the students. We asked them to analyze the building forms as examples of basic Euclidean geometric shapes and to find out if they had any ideas concerning their function. Our aim was to develop students' comprehension and perception skills and recognition of the geometric solids, they had learned in geometry studies. Through this exercise we aimed at emphasizing the use of geometry in the real world with these geometric solids offering real examples from life as buildings with various functions. This exercise was also the first step in improving their ability to make geometric analysis of the built environment. In the fourth activity we asked them to color or give texture to an interior perspective drawing and aimed at teaching the students to perceive space, a three dimensional medium with its two dimensional elements, while at the same time understanding the effects of color and texture in space. We noted that this activity could be further developed for the integration of art courses on developing techniques in coloring. Discussion on color, texture and space helps to improve perception of the environment and to provide a medium for exploring space, color and psychology. By the completion of unit one, students were able to understand what architects do and how their mathematics, even art and psychology courses, could be related to life i.e. to the built environment. The final activity consisted of a written composition in which they discussed the built environment in their home town using the information they had learned in unit one.

We aimed to show to the students, the relationship between human dimensions and the built environment, furniture and objects. There were two activities in this unit, which also included a drama to be performed by the students. Through the drama we aimed to reveal the interactive relationship between architecture and society and laid emphasis on how architecture influences people and their way of life. The second activity was the introduction of 'function' in architecture by introducing different building types. The third and fourth activity concentrated on developing the dimensional relationship between the human body, furniture and buildings. Students also practiced taking averages in order to understand the development of standards. Measuring, dimensioning and taking averages in mathematics were related to architecture and consequently found meaning in real life. Activities in this section required direct student involvement in measuring the furniture and spaces around them. Through this exercise students learned about the dimensions of spaces, standard dimensions of furniture, equipment and their spatial relationship with the spaces they are housed. The fifth activity in this section was dimension guessing. In this activity we aimed at developing students' skills relating to the perception of the environment in terms of proportions which would enable them to understand 'each part within the whole'. By the end of this unit students were able to measure the furniture and spaces in their environment, scale dimensions through guessing and understand the practical outcome of measurements in mathematics.

We aimed at developing the students' ability to perceive orthographic presentation, i.e. plans, sections and elevation drawings. The first activity was to draw the plan of their classroom as an exercise in orthographic presentation and as a means of understanding space, furniture and the relationship between the two. The second activity was to draw the plan and elevation of basic geometric shapes. This enabled students to understand the formal characteristics of basic geometric forms. The third activity was a design problem. We asked students to design their room. With this activity we aimed to show how knowledge of geometry, scale and orthographic presentation methods would help them to realize their ideas and creativity.

We aimed at equipping students with the skill to analyze the built environment in terms of geometric surfaces, forms and volumes, which in turn helped them to develop their sense of geometric relationships and proportions. Students were asked to analyze space in terms of geometry. They worked on an activity in which they were given a text which described a built environment made up of basic geometric forms and were asked to define its form in terms of its edges and surfaces. The second activity was the drawing of a plan of a neighborhood from a description of its elements using geometric terminology. The third activity was about understanding the plan of a building from its photograph. These activities enabled the students to understand their environment and to perceive the relationship between architecture and geometry.

We aimed at teaching proportion and ratio and their relevance to architecture and aesthetics. In the first activity the students were given photographs of portraits and buildings of true and distorted proportions and were asked to discuss these in terms of aesthetics. The second exercise was about a Renaissance building where proportions were shown on the elevation drawing. Students were asked to design a facade using a similar pattern. Site visits to historic places were organized where students discussed the buildings in situ.. The last activity was a design of 'The most beautiful house', in which they could use orthographic projection methods or models to express their ideas.

### **Evaluation and Conclusion**

The program was assessed through the evaluation of the activity sheets, i.e. the performance of the students who attended the program and the reports of the advisors who carried out the program. The students' motivation and their competence in completing the exercises were evaluated. At the end of the program, the advisors reported changes for the positive that they perceived in their students' competence and attitudes. The teachers also reported that the design club was helpful in keeping the students motivated for learning. This program had an effect on the development of concern for the environment. Architecture and environment seemed to become a part of the students' agenda. The feedback obtained from the advisors who carried out the programs was an indication of the usefulness of the program.

This study was aimed at the development of an integration of architecture and mathematics with the aim of developing an awareness of and concern for the built environment. Findings from another study revealed that the physical characteristics of the environment and social factors in terms of education level of the family influence students' awareness and perception of the environment (Erkin&Soygenis,2004) )The proposed extracurricular program was effective in increasing students' awareness and sensitivity towards the built environment reflecting the role of education in environment.

**Endnotes**

1. Research titled ‘Yapay Fiziksel Cevre Egitiminin İlkogretim Programlarına Entegre Edilme Surecinde Mimarlık Matematik Iliskisi’ (Relationship of Architecture and Mathematics in the Process of Integration of Education of Manmade Physical Environment to Elementary School Education Programs) granted by TUBITAK.( SBB 6004)

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