

THE IMPACT OF COGNITIVE STYLES ON DESIGN STUDENTS' SPATIAL KNOWLEDGE FROM VIRTUAL ENVIRONMENTS

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ABSTRACT

In parallel with the technological developments dominating usage of digital tools in science and education, caused the transform of knowledge in new ways. The reflection of these integration is seen in design discipline as its active role in this circle whether in practice or in the era of education, Benefit from the capabilities of new technologies in the education process for increasing design students' spatial knowledge, benefit from them digital tools also effect their carrier life in positive direction. By noticing the traditional education methods which are still using in many design school, the endeavor indicates that determine the appropriate learning method by considering individuals different cognitive style. The cognitive styles mean classify individuals according the way of perceive information and process it. Through this way, as subjects of the study, students categorized in respect to their cognitive styles whether field dependence or field independence, and then the relation between their cognitive style and spatial knowledge acquisition from virtual environment was observed. While defining digital tools in design education, the need of differences related to cognitive styles should be considered, this is supported by the data from this study which are indicating the increase of students' spatial knowledge in different scale of virtual environments.

Keywords: Cognitive style, design education, virtual environments, spatial knowledge.

1. INTRODUCTION

Computer usage which enables the creation of seemingly impossible design and design products has expanded horizons in architectural practices and education like in all other professions, computer programs which assist in line drawings has acquired more common usage area in every stage of design depending on new software and development of communication technologies. Designs are animated in virtual environment, thereby experienced, shared on platform which enables international exchange of ideas. With the validity of information which is obtained from digital media created by computer programs becoming data in the studies of real environment designs and formation of studies in this way; the issue of perceiving spatial knowledge has become more and more important (Çubukçu, 2005). In the study in which it is aimed to determine strategies suitable for the creation of studying environment in parallel with the innovation of information age, considering individual differences, individual perception differences and level of spatial knowledge design students acquired from virtual environments were presented depending on cognitive styles.

Terms of cognitive style or learning style have been frequently elaborated by education theorists in the last sixty years and it was seen that they have used different terminologies in their statements (e.g. Witkin et al, 1971; Goldstein and Blackman, 1978; Tennant, 1988; Biggs & Moore, 1993; Riding & Pearson, 1994). The term cognitive style which is the intersection of common approaches can be defined as individual's attitude towards organization, process and approach information and it was underlined that this is independent from the intelligence of individual (Messick, 1984). The way we pay attention to the information around us and the way we acquire it, the way the information is processed and stored by the brain, our approaches in problem solving are related with our cognitive thought (Solso, 2007). The effect of individual on performance may change in negative or positive direction depending on the kind of task; it is seen that specific styles can reach better results by adapting to specific tasks (Riding, 1996). For example, individuals who have field dependent (holistic) cognitive style may have difficulty in analyzing the new information by decomposing it; however they have higher ability of retaining general perspective. This style provides them skill in perceiving the general frame. Individuals who have field independent (analytical) cognition are prone to decompose new information and relate them with stored information. They have high tendency towards regarding in pieces rather than perceiving full-scale (Riding, 1997).

Although there are many tests used in the determination of cognitive styles, Witkin's Group Embedded Figures Test which aims to determine Field Dependence-Field Independence, in other words skill of Analytical thinking was preferred since it provides basis for the others and has higher validity values (Witkin, 1971). According to finding simple geometries hidden in a complex field; it is possible to define field independence or individuals who have analytical cognitive style and individuals who have dependence cognitive styles and cannot show the same performance in finding hidden geometries simply as defining these individuals as those who mark the trees when they look at a forest picture and those who simply see the forest itself (Parkinson, 2002).

Studies show that field independent individuals display better performance in computer assisted and internet interactive environments compared to those who are field dependent. In his study Post (1987) determined positive relation between field independency and success in computer assisted environments. Waugh (1993) mentioned that field independent individuals are better in text-based processes; however visual-graphical environments can be more efficient for field dependent individuals (Parkinson, 2002). In this study, inferences of field dependent and field independent individuals in a virtual environment which is composed of motion animations, fictions including more perceptual load (Strehler, 2008) compared to texts and stable visuals will be analyzed. In addition to this, it will be mentioned that information transfer from visual environments depending on cognitive styles provides what kind of data especially to those who receive design education and whose success is influenced by three-dimensional thinking skill and information obtained from the environment. Depending on the cognitive styles in learning, it was aimed to examine environmental data obtained from the digital media and utilization of digital tools as spatial information resource in accordance with design education.

2. METHOD

2.1. Sampling

The sampling of the study is composed of 36 prospective interior architects chosen with simple random sampling among third class students who receive education at İzmir University of Economics, Fine Arts Faculty, Department of Interior Architecture and Environmental Design (n=36). Students were entitled in the department according to their scores in Turkish-Mathematics fields in university examinations. 14 of the participants are male and 22 are female students. First of all the students were applied cognitive style test (Group Embedded Figures Test) and then a test composed of nine questions which was developed by researchers was applied to students in order to determine the level of knowledge they have acquired from virtual environments.

2.2. Assessment of Participants' Cognitive Styles

In the determination of cognitive styles of all participants, Witkin's Group Embedded Figures Test which is a standard tool whose validity and reliability study was done was used. Spearman-Brown test reliability of "Group Embedded Figures Test" developed by Witkin (1971) was found .82. "Group Embedded Figures Test" is composed of three sections with seven, nine and nine questions and there are 25 items in total. The students are expected to answer the test in two, five and five minutes respectively. The first section which is composed of seven questions is the stage of training and is not included in the evaluation; in the second and third sections which are composed of nine questions students were classified in the sense of field dependence and field independence according to the ability of finding hidden simple figures within complex figures. In other words, the number of simple figures they found reflects the level of individual's "field dependence".

2.3. Determination of the Knowledge Level Obtained from Virtual Environment

Interior architecture third class students were grouped according to their cognitive styles, their information obtained from virtual environment was defined, statistical analyses were done and relation/irrelation between these data and cognitive styles were determined. The field in which the spatial knowledge will be questioned in the study is four-dimensional animation movie which takes place in the interior and exterior spaces in different complexity levels (Figure 1). The animation which was produced by Triotech firm is composed of interior spaces and exterior spaces with different densities such as roads, streets which a student passes through on his way between house and school.

Participants first of all experienced four-dimensional animation movie which lasts four minutes. Different from computer screen, motion and wind effects were used from time to time during observation of virtual environment in order to perceive the sense of reality. Following the virtual environment students have experienced in groups of four people, students were expected to answer tests which measure their spatial knowledge level individually in order not to divert their attention away. After a couple of minutes' rest; students who have watched the animation perform a test which examines their knowledge of route, knowledge of map, distance estimations and sketches about environment.

2.4. Data Analysis

Data obtained from test applications of students will be analyzed by using Windows Excel program for accounting data; by using Windows SPSS program for statistical data. Data obtained from student statements and test applications will be analyzed and interpreted by using techniques such as Pearson, Chi-square and one-way variance analysis (ANOVA).



Figure 1. Interior and exterior space samples observed in the animation

3. FINDINGS

As it can be observed from the table below, of all 36 students – 22 female and 14 males- 13 of the students were evaluated as field-dependent and 23 were evaluated as field-independent (Table 1). As a result of the analysis of data, there was no relation between gender and field-dependence.

Table 1. Distribution of cognitive styles of participants

	FEMALE	MALE	Total
Field-dependent	7	6	13
Field-independent	15	8	23
Total	22	14	36

In order to measure the virtual environment knowledge of third class interior architecture students who are grouped according to their cognitive styles, a test which examines their knowledge about environment they have experienced was applied to them. Students were expected to draw the first and last space they have seen as sketches, and a result the relation between this drawing and cognitive style was analyzed. There was a positive relation between success of drawing sketches and field-independence compared to others ($p < 0.05$).

Table 2. The relation between cognitive styles and success of drawing sketches

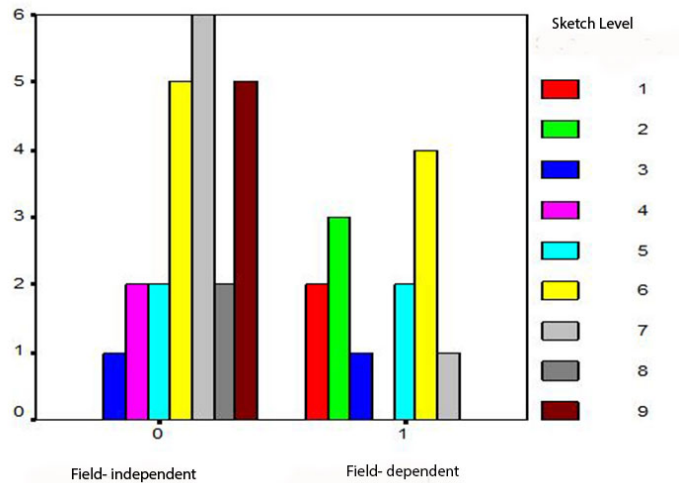
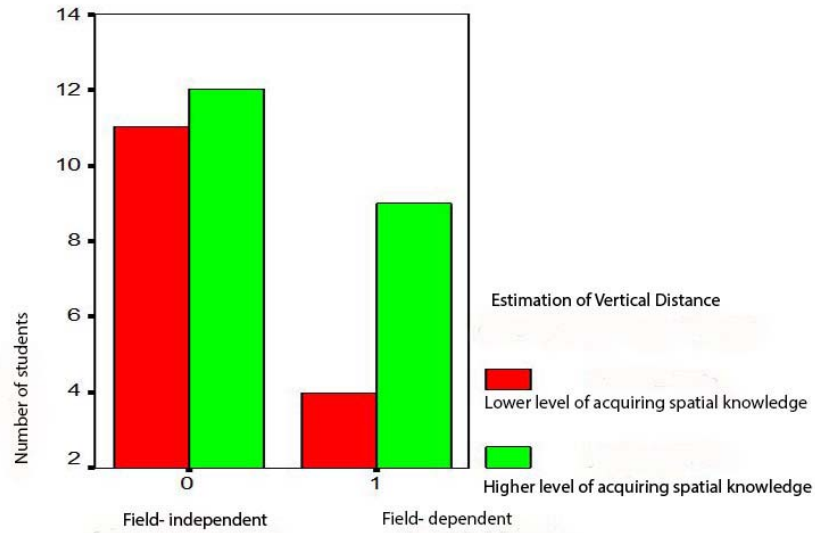


Table 3. The relation between cognitive styles and estimation of vertical distance



It was determined that students give similar answers to the questions about vertical distance or highness, therefore neither of the cognitive styles has superiority over other in the perception of vertical. When general success and cognitive styles are compared, it can be said that field-independent students have higher level of acquiring spatial knowledge. In addition to this, the level of spatial knowledge acquired by the whole cognitive styles can be qualified as positive. Therefore in this study it was seen that all the participants acquired meaningful spatial knowledge.

Table 4. The relation between cognitive styles and level of general success

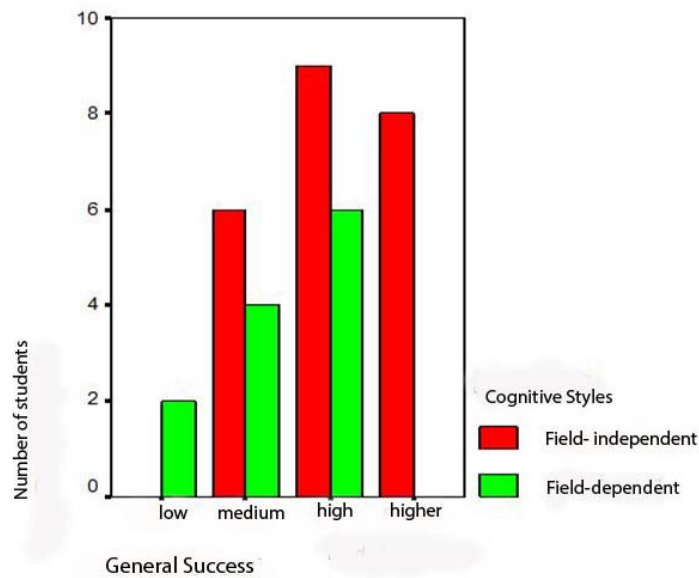
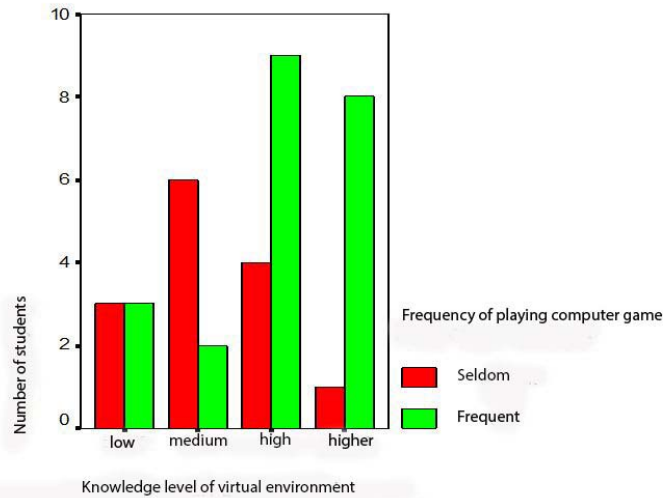


Table 5. The relation between knowledge level of virtual environment (General Success) and the frequency of playing computer game



In the scope of study many analyses were done in which cognitive styles are dependent variables. Sometimes these analyses indicate significant relations between specific variables and sometimes showed that these relations are independent from each other. Although there is no connection between cognitive styles and playing computer game, it was observed that students who play computer game are frequently more successful in acquiring knowledge from virtual environment ($p < 0.05$). When frequency of playing computer games is being determined, students' answers were grouped and three in a week and more was accepted to be frequent, three in a week and less was accepted to be seldom.

4. RESULTS

In this study in which the level of knowledge of design students acquired from virtual environment is assessed; it is seen that individuals who are at the specific groups of cognitive styles acquired different knowledge from virtual environment compared to others. There was a meaningful relation between students' cognitive styles and success of acquiring knowledge (general success) from virtual environment. However there is a point here to be mentioned that virtual environment - including real-like effects - has positive influence to the increase of all students' level of spatial knowledge. Supporting the studies about the view that the attitude of design students towards computer usage is positive, it is thought that the significant relation between frequency of playing computer games and general success shall not be ignored.

The unexpected situation was about the fact that field-independent students are more prone to drawing and design in computer environment. Findings of this study support the studies which show that there is no relation between cognitive styles and computer usage (Pektaş, Erkip 2006). Drawings of field-independent students by referring to three-dimensional objects in describing the space reflect their tendency of thinking in pieces (Riding, 1997). In their studies; Goldstein and Blackman (1978), Macleod Jackson and Palmer (1988) have analyzed the relationship between cognitive styles and spatial skill and mentioned the relationship between field-independence scale and spatial skill. That the results of analyses of general success data are in this way proves that the study gives parallel results with these thoughts.

Due to individual differences which are emphasized by cognitive approach, personal needs, expectations, perception styles and learning preferences of each student are worth considering. The sense of education which aims to bring designers of digital age is expected to be fed with cultural essence and enriched in interaction with technological opportunities. It is estimated that the effect of cognitive styles deserve more praise in students' acquiring spatial knowledge from virtual environment and it would be beneficial in improving spatial knowledge acquisition in design education. This is because of the fact that individual differences influence techniques and methods used in the processes of acquiring and processing information and may cause difference in the expectations towards learning environment. In this sense, difference of user depending on the cognitive styles should be considered while defining Virtual Education Environments in design field.

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