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Comparison of Conventional and Computer-aided Drafting Methods from the View of Time and Drafting Quality

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Abstract

Problem Statement: Drafting course is essential for students in the design disciplines for becoming more organized and for complying with standards in the educational system. Drafting knowledge is crucial, both for comprehension of the issues and for the implementation phase. In any design project, drafting performance and success are as important as the design process, especially in the educational environments aimed at professional life. However, there have been relatively any studies undertaken in the area of the success and time saving of the conventional drafting and computer-aided drafting (CAD) techniques, besides the design process, especially for furniture and interior design educations. In this direction, some questions emerge in the study. Is there really a difference on quality, success and drafting time between conventional drafting and CAD techniques in interior drafting field? If there is a difference, at which time or process does the drafting technique gain speed?

Purpose of study: The purpose of this study was to determine the effects of conventional and computer-aided drafting (CAD) techniques on drafting performances of design students. Furthermore, it was explored which technique was more time, speed and quality-efficient.

Methods: To verify this study, students were asked to draw a sample of a two-dimensional technical drawing with an interior plan by using the conventional and CAD techniques at different times within a 60-minute

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period. The task was designed to ensure that the students understood the principles of technical drawing and could edit sufficiently to draft the plan.

Findings and Results: According to the results, it can be stated that there was no meaningful difference between the decision-making process for choosing the drawing method and perceiving the drawing was made by the students with both methods in the first 5 minutes. The difference in quality may be due to the advantages of the CAD technique at the 30th minute. At the end of the 60th minute, a huge difference was observed between the conventional and CAD and the CAD was more successful than the conventional drafting. Consequently, the CAD technique has a better outcome from the aspect of time and quality compared to the conventional technique.

Conclusions and Recommendations: It can be stated that CAD has a significant impact on the drafting performances of design students from the aspect of time spent. The furniture and interior design departments should place emphasis on the educational process for the drafting technique in order to increase quality and save time. The drafting course hours should be increased for the design students, so that drafting success can become more efficient for those entering in the professional area.

Keywords: Architectural drafting; Conventional drafting; Computer-aided drafting; Drafting tools; Drafting quality

Introduction

It is typical in interior design to use various relatively unstructured forms of pictorial representation, such as sketches, which enable the investigation of requirements and conditions of the problem space and the solution spaces (Cross, 1999), in the early stages of the design process. As the design develops, other more structured forms, such as plans or sections, become a part of the process (Purcell & Gero, 1998). Universally, this part of the process is referred to as technical drawing or drafting. Drafting is a common language in interior design and related disciplines. The ability to understand as well as complete plans, sections and elevations is universally accepted as the core skill among these disciplines. For example, drafting allows for the configuration of an interior and the arrangement of furniture/ equipment/features for an interior designer. Drafting education is essential for students in the design disciplines for becoming more organized and for complying with the standards in the educational system. However, drafting knowledge is crucial, both for comprehension of the issues and for the implementation phase.

Since the early 1900s, drawing has been recognized in higher education, not only as being of practical use, but also as a cognitive development tool and a "powerful engine of calculation" (McLaren, 2008). The hand drawing techniques were the basic drawing skills for the design disciplines until the 1960s. In the mid-1960s, the computer-aided drafting (CAD) technique was introduced as a tool for the output of drawings without the use of conventional drafting tools. Technological advances have prompted a gradual transition from a reliance on conventional drafting tools to

the use of CAD. Today, personnel in almost every institution and industry in the world are using more CAD in their work than in the past (Kashef, 1993). As computer technology has become a fundamental part of the design process in education, a debate has also arisen among the concerned educationalists as to how the visualization ability advances differently between the CAD and conventional techniques.

In their study, Brandon and McLain-Kark (2001) compared the use of conventional and CAD techniques in the developmental design process on the ratings of aspects of design merits present in the final design solutions. They concluded that there was no significant differences in the design merit ratings of the conventional and CAD techniques. Both conventional and CAD techniques were effective in the conceptual stage of the design process to produce design solutions that were appropriate, complex, creative, novel, likable, original and thematically expressive.

A greater sense of artistry, developed skills in spatial awareness, visualization and pre-planning are required for the conventional drafting technique (McLaren, 2008). Besides, it creates a greater sense of achievement and a feeling of ownership. The indefinite precision, long time needed to make sufficiently accurate drawings of complex objects and the technical skills required are the negative aspects of the conventional technique (Callieri et al., 2006). This technique needs an absolutely plain and smooth surface and requires a lot of concentration.

A greater degree of straightness, reduction in time loss and drafting work and the fact that it is quicker and more accurate than conventional drafting are the advantages of the CAD technique. Consequently, it takes less time to complete a project (Senyapili & Basa, 2006). CAD software supports sketching, drafting and rendering, photo-altering and three dimensional capabilities. CAD software, such as AutoCAD, has been incorporated often into later design process stages where drafting revisions and producing construction drawings and specification documentation are typically performed (Brandon & McLain-Kark, 2001). The use of 2D programs can increase the speed of repetitive tasks dramatically when making changes to drawings (Downey, 1992). On the other hand, the CAD technique seems to force the students to conclude their designs hastily without exploring sufficiently what was being drawn (McLaren, 2008). In addition, eye fatigue, increase in equipment required and added work expense are the negative aspects of the technique.

There have been many studies on the effects of conventional and CAD techniques in the design process (Brandon & McLain-Kark, 2001; Case & Matthews, 1999). There are also studies on the strategic uses of conventional and CAD systems to increase the efficiency of drafting methods (Bhavnani & John, 1996; Flemming, Bhavnani & John, 1997; Magi, 2009), as well as the effects of Computer–aided drawing in the engineering field (Beitz et al., 1990; Majchrzak, 1990; Rafi et al., 2006). However, there have been relatively any studies undertaken in the area of the success and time saving of the conventional and CAD drafting techniques, besides the design process, especially for furniture and interior design education. In any design project, drafting performance and success are as important as the design process, especially in the educational environments aimed at professional life. Some studies indicated that

CAD provides faster and more precise results than conventional drafting. For instance, in their book, Miller and Schlitt (1985, p.494) stated …a sheet of details that would take 40 hours of manual drafting can be produced in 20 minutes with a level of finish and accuracy beyond what the best human draftsman can manage… However, this statement was not supported with any experiment.

Based on the above discussion, some questions emerge in this current study:

1) Is there really a difference on quality, success and drafting time between conventional drafting and CAD techniques in interior drafting field?

If there is a difference,

2) At which time or process does the drafting technique gain speed?

Based on these questions, it is aimed to find out the differences in the drafting time and quality of the drafting performances of students using the two different drafting techniques, i.e., conventional drafting and CAD, by implementing an interior plan drafting task.

Method

The following methods were employed to the research test.

Participants

The research was conducted on 18 male students selected among the 4th year students at Gazi University's Faculty of Technical Education, Department of Furniture and Decoration direction to the interior design education since the last 12 years. Selected students, had no health problems, no physical abnormalities and no orthopedic disorders, and had previous experience using conventional drafting (hand drawing) and CAD techniques. All the participants were between the ages of 18 and 23. The data for the present study were obtained in 2010 in the conventional and computer classrooms at daytime classes during the weekdays.

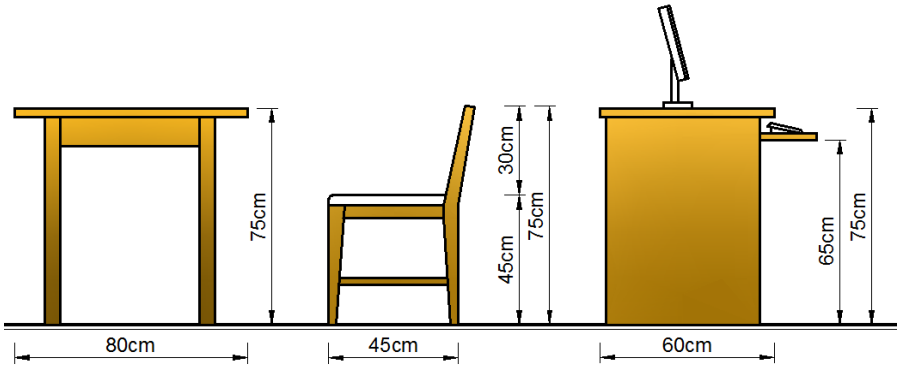
Environmental Settings

The environmental factors of a school classroom can have a positive or negative effect on a student's learning and behavior in the classroom. For this reason, well-designed environments make a positive impact on students' motivation and concentration so as to improve their learning and/or performing skills. With this in mind, the physical environmental factors have been defined for the reliability of the study.

Drawing is the main action performed in drawing spaces that can serve different functions. The equipment necessary for conventional drawing include tools, such as a drawing table, a chair, t-ruler, miter, French curve, drawing paper with template, drawing pen, erasers, etc. for each student. Equipment, such as a computer table, a chair, an LCD screen with case, keyboard and mouse are the primary tools for CAD. The main equipment elements common to both techniques are drawing tables and chairs.

In this study, the conventional design studios, computer labs and tools, available at Gazi University, Faculty of Technical Education, Department of Furniture and Decoration, were utilized in the drawings made by participants. Conventional and

CAD tables and chairs used in the study are depicted in Figure 1. The chairs were the same for both trials.



Conventional drawing table *Chair* *Computer-aided drawing table*

Figure 1. Drawing tables and chairs used in the study

The drawing tables available in the conventional design studio were used in a horizontal position. The tables were 80x100 cm, with a ground clearance of 75 cm. The computer tables available in the computer labs are 60x70 cm, with a ground clearance of 75 cm. The tray on which the keyboard and mouse were situated is 45x65 cm, with a 65 cm ground clearance. The seat surfaces of the chairs were 45x45 cm, the backboard surfaces are 18x50 cm, and seat height is 45 cm. Other features of the classrooms in which the trials were conducted are as follows:

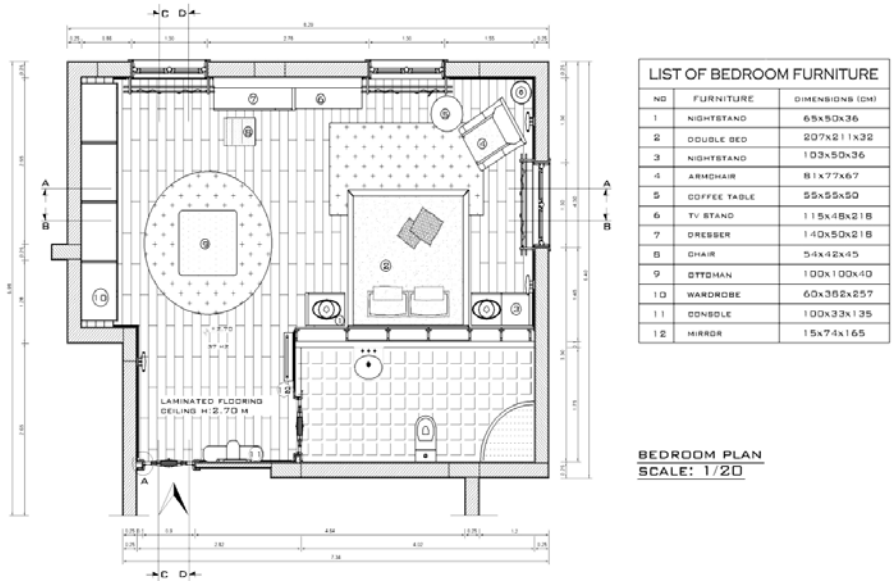
- The spaces were the same size (53.4 m² each), but with different placement and characteristics of the drawing tables (i.e., conventional drawing table, computer drawing table) and presence of different paintings and plants.
- Along the southeast wall were four square windows (one for each bay), measuring 200 cmx200 cm. The windows were all operable and daylight glare could be controlled with curtains.
- Daylight on the southeast facade on a clear day registered approximately 550 lm on a light meter for 80% of the workday, providing sufficient illumination level without glare.
- The use of artificial light in the classrooms was inevitable. There were fluorescent light fittings in the 2.60 m-high suspended ceiling, each providing 160 lx, which was sufficient for general illumination at both floor and table level.
- The internal air temperature –with the help of air conditioning in the summer– was maintained between 22°C and 24°C in both the conventional and computer classrooms.

Procedures

This research determined the drafting performance of students with two different drafting techniques, i.e., conventional drafting and CAD, on the quality and drafting time for an interior plan drafting task. The task was designed to ensure that the

students understood the principles of technical drawing and could edit sufficiently to draft the plan. For this study, an interior plan drawing was used as the experimental setting. The task consisted of a bedroom plan that had all interior details identified with furniture, showing floor coverings, furniture placement and dimensions. The numbers refer to an informational key.

The students were given a copy of the drawing on a sheet of paper and were asked to draw the same plan with all details (Figure 2). They were given 60 minutes to complete the task (Figure 3). The whole drafting process was checked and scored at 3 time points on the 5th minute, 30th minute, and the 60th minute. Therefore, the effects of the time factor on the drafting quality and success were measured. Same rating system was also used in previous studies (Oshima, 1970; Yildirim & Kasal, 2005).



LIST OF BEDROOM FURNITURE

NO	FURNITURE	DIMENSIONS (CM)
1	NIGHTSTAND	65x50x36
2	DOUBLE BED	207x211x32
3	NIGHTSTAND	103x50x36
4	ARMCHAIR	81x77x67
5	COFFEE TABLE	55x55x50
6	TV STAND	115x48x218
7	DRESSER	140x50x218
8	CHAIR	54x42x45
9	OTTOMAN	100x100x40
10	WARDROBE	60x382x257
11	CONSOLE	100x33x135
12	MIRROR	15x74x165

Figure 2. The task of the bedroom plan drawing sheet that was given to the students

During conventional drafting	*During computer-aided drafting*

Figure 3. Participants engaged in conventional and computer-aided drafting

The drafting performance scores were evaluated with six measurements as (1) walls, (2) sections, (3) furniture, (4) interior order, (5) hatching and (6) dimension, symbols and the list of furniture for a total score of 100 (Table 1). The complete levels of the students finishing a drawing in a given time were measured with this procedure. The working-times were measured by the same lecturer.

Table 1.

Sample of the Scoring Method between the Ranges of Each Evaluation

Furnishing Plan Layout	Score	Conventional	CAD
Walls	10		
Sections	15		
Furniture	30		
Dimension, symbols and the list of furniture	20		
Hatching	15		
Interior order	10		
TOTAL Score	100		

Both the conventional drafting and CAD courses at the department (Table 2) are given starting in the 2nd year of education. The courses include making and interpreting orthographic and pictorial views, imagining sections and details of objects, knowledge of the norms of technical drawing, expression, dimensioning and ability in manipulating efficiently conventional and computerized instruments of drawing. The activities in this education are predominantly individual and based on practice, as well as on evaluations.

Table 2.

Distribution of drafting lectures

Lectures	Number of Lectures in a year	Weekly hours	Total number of hours
2 nd year			
Basic drafting education (conventional)	2	8	120
Basic CAD education	2	6	90
3 rd year			
Group furniture design (contains both)	2	8	120
4 th year			
Interior design (contains both)	4	16	240
Total	10	227	570
Other lectures (not related)	56	189	2835

Results and Discussions

The reliability of the items, including the drafting performances of the students in the two different settings (conventional and CAD drawings), were tested using the Cronbach's alpha test. The Cronbach's alpha coefficient estimate of internal consistency for the scale, including the average scores for the three items, was 0.67. The coefficient of all items was above 0.60, representing good reliability according to some researchers (Bagozzi & Yi, 1988; Jayasinghe et al., 1997; Grewal et al., 1998; Kim & Yin, 2001; Pektas & Erkip, 2006; Ahmad et al., 2010). Therefore, the scale was considered to be reliable.

In the next part of the analysis, the statistical relationships between the drafting performances of the design students and the differences in the conventional drafting and CAD techniques were analyzed. The results of the scoring between the range of each evaluation (at the 5th minute, 30th minute, and 60th minute) are given in Table 3 as the mean, standard deviation, etc. for each of the items of the dependent variables. When the means in Table 3 were considered, the differences in the conventional drafting and CAD techniques seem to have positive effects on the performances of students.

Table 3.

Descriptive Values of the Dependent Variables

Dependent Variables		N	Means	SD	SE	95% Confidence Interval for Mean		Min.	Max.
						Lower Boundary	Upper Boundary		
5th Minute	Conventional Drafting	18	5.500[a]	1.977	0.466	4.516	6.483	3	11
	Computer-Aided Drafting	18	6.166	2.202	0.519	5.071	7.262	3	12
	Total	36	5.833	2.090	0.348	5.125	6.540	3	12
30th Minute	Conventional Drafting	18	27.888	7.210	1.699	24.303	31.474	12	41
	Computer-Aided Drafting	18	38.166	7.830	1.845	34.272	42.060	24	51
	Total	36	33.027	9.066	1.511	29.960	36.095	12	51
60th Minute	Conventional Drafting	18	49.111	9.892	2.331	44.191	54.030	37	75
	Computer-Aided Drafting	18	66.777	10.189	2.401	61.710	71.845	50	94
	Total	36	13.350	13.350	2.225	53.427	62.461	37	94

Notes: n: number of subjects, m: mean value, sd= standard deviation, se= standard error

[a] Variable means ranged from 1 to 100, with higher numbers representing more positive responses.

The differences between the drafting performances of the students for the differences in the conventional drafting and CAD techniques were tested by using the Analysis of Variance (ANOVA). According to the results given in Table 4, the

scores of the students in the first 5 minutes between the conventional and CAD drawings were not found to be statistically significant at a level of $p<0.05$. In contrast to this result, the scores of the students in the 30th and 60th minute between the conventional and CAD drawings were found to be statistically significant at a level of $p<0.001$.

Table 4.

ANOVA of the Dependent Variables for the Conventional Drafting and CAD

Dependent Variables		Sum of squares	*df*	Mean squares	F	Significant
5th Minute	Between groups	4.000	1	24.300	0.913	0.346[ns]
	Within groups	149.000	34	0.848		
	Total	153.000	35			
30th Minute	Between groups	950.694	1	26.133	16.780	0.000[a]
	Within groups	1926.278	34	1.107		
	Total	2876.972	35			
60th Minute	Between groups	2809.000	1	28.033	27.853	0.000[a]
	Within groups	3428.889	34	1.167		
	Total	6237.889	35			

Notes: df: degree of freedom, ns: not significant [a] α: 0.001 is the level of significance

According to the results, it can be stated that the decision-making process for choosing the drawing method and perceiving the drawing was made by the students in the first 5 minutes. The difference in quality may be due to the advantages of the CAD technique at the 30th minute. At the end of the 60th minute, a huge difference was observed between the conventional and CAD, and the CAD was more successful than the conventional drafting. Especially, hatching techniques were achieved better and gave clean results with the CAD.

Students finished the furnishing layout, and the interior order was more successful with the CAD drawings. However, students could not finish the dimensioning, symbols and the list of furniture in 60 minutes in either of the drafting techniques. The participants were the 4th year students, and they have been learning and training drafting techniques since the 2nd year with the various lectures. In addition, the examination time was determined as 60 minute as a standard in the curriculum. The department prepares exam questions according to the duration time which can be completed within this duration. With this in mind, in the study, it has been expected to complete the drawings in 60 minute from the students who have provided the necessary knowledge. At the end of the 60th minute, none of the students were able to completely finish the drawing with either the conventional drafting or CAD techniques (Figure 4). This may be due to the fact that the lecture hours and/or lectures were not sufficient for the students to learn and practice drafting. Beside the basic education of drafting, the students need to learn by practicing and experiencing with more projects. For these reasons, course duration and content of the training program needs to be improved.

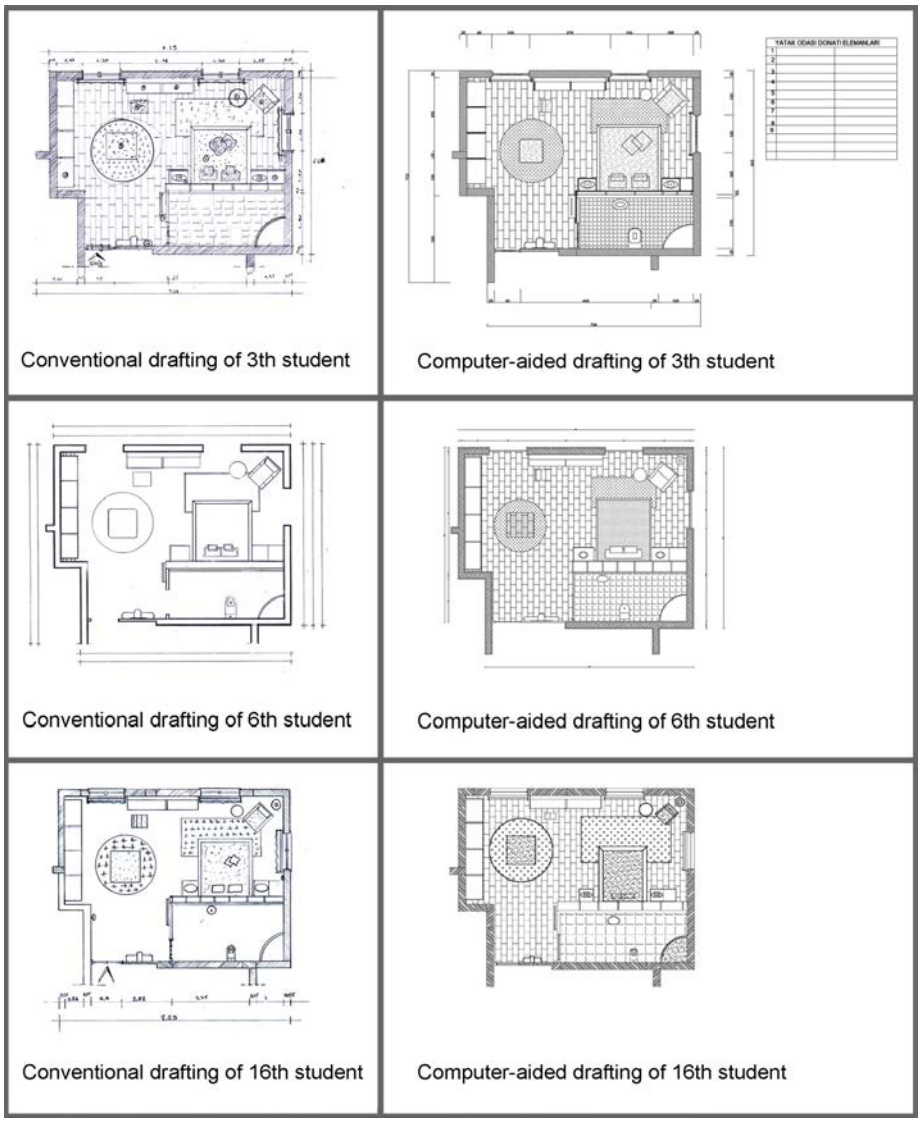


Figure 4. Examples of the final solution drawings using conventional drafting and computer-aided drafting

The graphs of the differences between the scores of the students for the differences in the conventional drafting and CAD techniques depending on their drafting performances are given in Figure 5. According to the results, the CAD drafting technique has a better outcome for the furniture and interior design students from the aspects of saving time and drawing quality compared to the conventional drafting.

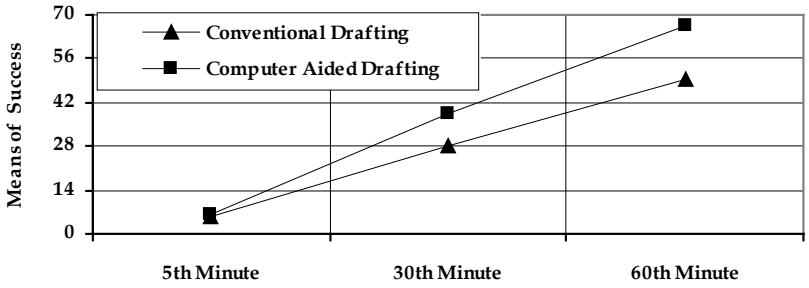


Figure 5. Effect of the drafting techniques on the scores of the students

According to the results, CAD has a positive effect on the drawing performance of the students, which increases with time. Also, our findings show that there is a large difference between the conventional and CAD techniques and that the CAD technique results in a much better outcome than the conventional technique.

Discussion and Conclusions

In this study, the completed level of a sample 2D technical drawing by furniture and interior design students was compared with their scores for different techniques. The evaluation scores of these drawings at different times (5th, 30th and 60th minutes) used to determine when there was an increase in quality and speed. Accordingly, in this study, it was possible to compare the quality and drafting-time for the same drawing made by conventional drafting and CAD.

According to the results, the CAD technique was certainly better and the creation-time was also normal compared to the conventional drafting technique. In conclusion, CAD has a positive effect on the drafting performances of students, which increases with time.

As a result of this survey, it can be stated that the furniture and interior design departments should place emphasis on the educational process for the drafting technique in order to increase quality and save time. Meanwhile, the conventional drafting and CAD weekly course hours appeared to be insufficient.

Consequently, drafting related course hours and the contents shall be dealt with entirely. Through the curriculum where the first 4 term mainly consisted of theoretical lectures as basic conventional and CAD lectures and during 5th to 8th term practice oriented lectures needs to be supported. Weekly hours of each course shall be increased, and new lectures aiming at drafting shall be added to the curriculum. Drafting is the outcome of the every project to commence production.

The educators should increase the drafting applications for the design students, so that drafting success can become more efficient for those entering the profession. Within this context, Dongel, Cinar and Sogutlu (2009) previously carried out a study

on the 3D visualization performance of students. They suggested the same conclusion, i.e., an increase in weekly course hours, instead of increased diversity in the lectures. Furthermore, there are some studies, which show that drafting education could increase the visual perception of students (Adanez & Velasco, 2004; Olkun, 2003; Flemming et al., 1997). According to these studies, taking a drafting course increased the perception and performance of the students. Further research will be conducted in order to provide insights into a detailed proposal on the course structure.

Educational institutions and their educators can use these results and suggestions to develop their curricula and thereby improve the success of students through improving their drafting techniques for saving time and increasing quality. Also, the results of this study may assist educators and institutions in teaching drafting techniques and in understanding the expectations of students entering into the furniture, decoration or interior design profession.

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Geleneksel ve Bilgisayar Destekli Çizim Yöntemlerinin Zaman ve Teknik Çizim Kalitesi Bakımından Karşılaştırması

Atıf:

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Özet

Problem Durumu: Teknik çizim eğitimi, tasarım disiplinindeki öğrencilerin eğitim sistemi içerisinde daha iyi organize olma ve standartlara uyma açılarından oldukça önemlidir. Bununla birlikte, teknik çizim bilgisi, konuları anlama ve uygulama aşamaları için de önemli yer tutmaktadır. Tasarım disiplinlerinde 1960'lara kadar el ile geleneksel dediğimiz çizim teknikleri temel çizim becerileri olarak görülmüş; 1960'ların ortalarında ise bilgisayar destekli çizim tekniği geleneksel araçlara gereksinim duymadan çizimleri oluşturtabilme ve çıktı alma özellikleri ile yeni bir teknik olarak ortaya çıkmıştır. Teknolojinin avantajları ile geleneksel çizim araçlarının yerini bilgisayar destekli çizim araçları almaya başlamıştır. Tasarım

eğitimi verilen ortamlarda bilgisayar teknolojisi önemli yer edinmeye başladıkça, eğitimciler de tasarımın görselleştirme aşamasında geleneksel ve bilgisayar destekli teknik çizim yöntemlerinin avantajlarını araştırmaya başlamışlardır. Literatüre bakıldığında, tasarım süreci için geleneksel ve bilgisayar destekli çizim teknikleri üzerine pek çok çalışma yapıldığı görülmektedir. Geleneksel ve bilgisayar destekli teknik çizim yöntemlerinin etkinliğini arttırabilecek stratejik kullanımlarının da araştırıldığı çalışmalara rastlanmaktadır. Aynı zamanda, mühendislik alanında bilgisayar destekli teknik çizim kullanımının etkilerinin de araştırıldığı görülmektedir. Ancak bu tür çalışmalar dışında özellikle iç mekan tasarım eğitimi alanında ve tasarım süreci dışında, geleneksel ve bilgisayar destekli teknik çizim yöntemlerinde zaman kazanma ve başarı düzeyi üzerine herhangi bir çalışmaya rastlanmamıştır. Profesyonel yaşama hazırlayan eğitim ortamlarında oluşturulan bir tasarım projesinde, teknik çizim performansı ve başarısı tasarım süreci kadar önemli yer tutmaktadır. Bu doğrultuda; (1) "Çizim kalitesi ve teknik çizim süresi bakımından geleneksel ve bilgisayar destekli teknik çizim (BDTÇ) yöntemleri arasında bir farklılık var mıdır?" ve (2) "Eğer bir farklılık varsa, teknik çizim hangi süreçte ya da sürede hız kazanmaktadır?" sorularına cevap bulunmasında büyük yarar vardır.

Araştırmanın Amacı: Bu çalışmada, geleneksel ve bilgisayar destekli teknik çizim yöntemlerinin tasarım öğrencilerinin teknik çizim performanslarına etkilerini belirlenmesi amaçlanmıştır. Ayrıca, çalışmada hangi yöntemin daha fazla zaman, hız ve kalite bakımlarından verimli olduğu ortaya konmak araştırılmıştır.

Araştırmanın Yöntemi: Çalışmada, Gazi Üniversitesi Mobilya ve Dekorasyon Eğitimi bölümünden teknik çizim derslerini yoğun olarak almış ve anket ortamında güvenilir sonuçlar verebilecek düzeyde 4. sınıf, 18 erkek öğrenci tesadüfi olarak seçilmiştir. Çalışmayı gerçekleştirmek için öğrencilerden farklı zamanlarda ve kendilerine verilen 60'ar dakikalık süreler içerisinde geleneksel ve bilgisayar destekli çizim yöntemlerini kullanarak iki boyutlu bir iç mekan yerleşim planını çizmeleri istenmiştir. Deney ortamı öğrencilerin teknik çizim ilkelerini ne derecede anladıklarını ve yeterli düzeyde tamamlama düzeylerini görebilmek için hazırlanmıştır.

Araştırmanın Bulguları: Sonuçlara bakıldığında, öğrencilerin verilen örnek çizimi algılama ve çizim yöntemine karar verme süreci, her iki çizim tekniğinde de ilk 5 dakika içerisinde eşit değerde olduğu görülmüştür. 30. dakikada ise bilgisayar destekli teknik çizim tekniğinin avantajlarından dolayı teknik çizim kalitesi farklılığı ortaya çıkmıştır. 60. dakikanın sonunda ise geleneksel teknik çizim tekniği ile bilgisayar destekli teknik çizim tekniği arasında büyük farklılık olduğu görülmüş ve bilgisayar destekli teknik çizim tekniği, geleneksel çizim tekniğine göre daha başarılı bulunmuştur. Sonuç olarak, bilgisayar destekli teknik çizim, geleneksel çizim tekniğine göre çizim sürecinin ilk aşamasında geleneksel çizim tekniği ile aynı düzeyde ve aynı kalitede olmasına rağmen süre arttıkça çizim hız kazanmakta, daha kısa zamanda kaliteli bir çizim oluşturma bakımından daha iyi sonuca sahiptir.

Araştırmanın Sonuçları ve Önerileri: İç mekan tasarım eğitimi verilen ortamlarda geleneksel çizim yönteminin yanı sıra, bilgisayar destekli teknik çizim yönteminin,

kullanılan zaman yönünden tasarım öğrencilerinin teknik çizim performansı üzerinde önemli bir etkiye sahip olduğu söylenebilir. Bununla birlikte, öğrencilere verilen süre sonunda, toplanan çizimler değerlendirildiğinde hiçbir öğrenci verilen çizimi tam ve doğru olarak tamamlayamamıştır. Bunun önemli bir nedeni, verilen eğitimde ders saatlerinin yetersiz gelmesidir. İç mekan tasarım eğitimi bölümleri, teknik çizim öğretiminde zaman kazanma ve çizim kalitesinin artırılması amacıyla eğitim sürecine önem vermelidir. Tasarım öğrencileri için teknik çizim ders saatleri arttırılmalı ve bu sayede ortaya çıkacak teknik çizim başarısı ile daha verimli olarak ortaya çıkacak başarı düzeyleri ile profesyonel meslek yaşamına geçmeleri sağlanmalıdır.

Anahtar Sözcükler: Mimari teknik çizim; Geleneksel teknik çizim; Bilgisayar destekli teknik çizim; Teknik çizim performansı; Çizim kalitesi