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## Computer Aided Design Reasoned Issues in the Interior Architectural Design Education

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### Abstract

*As the information technologies develop, the use of digital media can be seen as standard in many design fields today. Like in all other professions, this rapid alteration makes revisions and updates in interior design education ineluctable. Concerning the fact that interior architectural design education favors a dominance of final presentation over the design process in the studio environment, the evaluation discomforts caused by the computer generated presentations become much more critical. The main intention of this paper is to question, whether the attitudes of the students and the instructors on the subject is coherent with what they put into practice and discuss the reasons of these discrepancies. While majority of the instructors say that they positively approach to combined hand and computer techniques, the analysis of the final grade distribution for each technique displays another fact. Success ratio of the computer only presented projects are much greater than both hand drawn and hand and computer combined technique used projects. The results arise some major questions for the design education community to discuss.*

**Keywords:** Interior architecture, Computer aided design, Design education, Jury evaluation

### Introduction

Throughout the history the technological revolutions have affected the social evolutions directly and the discovery of every appliance, method or production technique has taken the society further in many fields like economy, culture and politics [1, 2]. These technological revolutions, especially the development in information technologies started to accelerate in the early 1980s, while the use of digital media has become widespread on every field in the 1990s, and considered to be a standard at the present day. This alteration has not only brought advantages to the traditional methods but also provided various new opportunities.

The common use of the digital media in the fields of design has gained speed analogous with these developments. It has quickly found acceptance among the design associated professions. At first a great many of designers who were trained and have worked on hand drawings throughout their design career have 'supported' the traditional design methods with the use of digital media in order to utilize these new opportunities and advantages [3, 4]. At following periods with the effect of these developments and the competitive conditions, this spread has grown with a speed for which it can be described as an outbreak. Simultaneously the systems composing this infrastructure have continued developing.

During this period the revolutions on the field of interior design have shown features similar to the other fields of design [5, 6]. Like all other design offices the interior design offices have adopted the digital media directly or indirectly. Like all other design offices the interior design offices have adopted the digital media directly or indirectly. This new atmosphere has supported the birth of the new design ideology.

Similar to all other design disciplines, the 'young designers' in the field of interior design have become the impulsive force in the spread of digital design culture [7]. As in all other professions, this rapid change experienced today, makes some revisions and updates on interior design education ineluctable.

### **Computer aided design reasoned issues in interior architectural design education**

Interior architecture professionals seem to welcome computer generated presentations in their projects more easily than academics [8]. Today, there are many studies focusing on the digital design process available in the literature [7, 9-11]. Some compare sketching activities in traditional (hand drawn) versus digital media (computer generated) [12] whereas some focus on the design thinking [13-17]. There are also many studies on digital design in other design professions besides the field of architecture [18-20].

Few of the studies focus on the difficulties and issues of the processes in which the computer drawn final design projects are evaluated. [8] focus on the jury's attitude during evaluation process on the projects made by computer generated presentation in their case study [8]. As also discussed in [8] these relatively new presentation techniques trigger several problematic issues during this evaluation process by means of 'loss of author identity', 'problems of authenticity' and 'proficiency of the instructor(s) in computers'. As stated in [8, 21] it is impossible to reject the fact that computers have made a big impact by their positive contribution to presentation on design education. In [21], students were asked to identify in which areas of the design process the use of computer aided design created a significant and positive difference. Drafting was voted as the major area of impact and the presentation as the third [8].

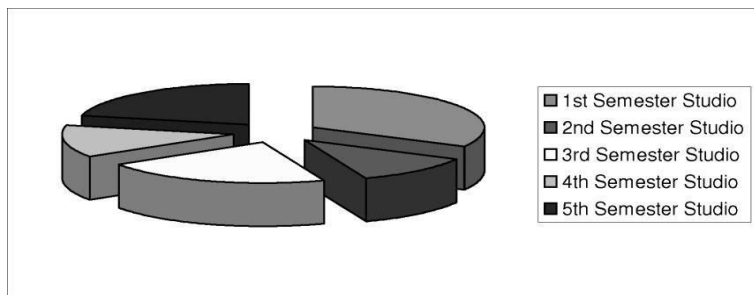
On the other hand, a full support of computer aided presentation is still feared to lead to the loss of hand drawing skills in time [8, 2, 23]. Concerning the fact that interior architectural design education favors a dominance of final presentation over the design process in the studio environment [24], the evaluation issues initiated by the computer generated presentations

become much more critical. In the light of the problems addressed above, a study is carried out with the students and instructors within an interior architecture curriculum to discuss the subject. The main intention of this paper is to question, whether the attitudes of the students and the instructors on the subject is coherent with what they put into practice and discuss the reasons of these discrepancies. For this purpose the interaction between the techniques used for presentation and the ratio of success in design studio, and the advancing levels of the students in computer use in interior architectural design are also evaluated in the study.

### Methodology of the study

In this study, a similar methodology is used as [8] to get reliable and accredited results. To get a more comprehensive discussion on the subject the methodology mentioned above is improved with additional questions in the questionnaires. As the past study mentioned above was accomplished in another institute with different curriculums and evaluation processes, and it was also not possible to reach some of the necessary information reversely, comparisons between the past and the recent studies are left out of scope.

First, the study was carried out in two phases to obtain views from instructors and students, in order to test and justify the propositions mentioned in the first section. Two independent questionnaires were handled with the design studio students and the instructors. 79 design studio students participated in the first questionnaire, 32 of whom are male and 42 of whom are female (47% male, 53% female). Distribution of the students according to their studio semesters are shown in Figure 1. 12 instructors participated in the second questionnaire, 8 of whom are male and 4 of whom are female (66% male, 33% female). None of the participating instructors were design studio instructors for a specific year or semester; on the contrary all have almost the same number of students from the 1st semester to the 5th semester design studio. In the first questionnaire conducted with the students, 10 questions with single choice answers were asked, whereas in the second questionnaire conducted with the instructors, 9 questions with single choice answers, were asked, yet noting the possibility that instructors may reveal additional views on the issue.



**Figure 1: Distributions of the students depending on their studio semesters.**

In addition to these studies, an additional phase was completed to throw fresh light on the discussion about the association between presentation techniques and the final grades of the students. In this phase, both the presentation techniques and the final grades of the students who

take design studio and conduct graduation project were separately collected and analyzed to check whether there is a certain relationship between these two parameters.

The necessity to make two separate analyses on this phase is caused by the difference in the evaluation processes of the two courses. In the design studio course, there is no jury and every instructor evaluates his/her own students' final projects separately, whereas in graduation project courses, a design jury consisting of design studio instructors evaluates the final projects.

Every semester a graduation studio jury consisting of five design studio instructors is formed in a rotation. Every student presents his/her project in front of the jury and answers the questions about the project in an open session for other students and instructors. After every student has presented his project the jury evaluates the projects in a closed session where every jury member gives a grade for each student. At the end of this evaluation process, all grades are collected from the jury members and the average is taken to calculate the final grade of the students.

The two separate analyses for the design studio course and the graduate studio helped to compare the personal and overall attitudes on presentation techniques. 15 students attended in the graduation jury, 9 of whom are male and 6 female (60% male, 40% female). To validate the results of the design studio students' questionnaire on final presentation preferences, graduate studio students' presentation technique preferences in previous design studios were also asked.

As expected, every design studio instructor and member of the graduation studio jury member evaluates projects according to many different factors of which 'quality of the usage of chosen presentation technique' is only one of them. Unfortunately instructors and jury members do not give separate grades for each evaluation parameter but only an overall grade for each project. When asked, each instructor states that he/she weights approximately 10-20% of the overall grade to the 'quality of the usage of chosen presentation technique'. However this approach is far from any kind of quality control mechanism and is strongly subjective. Also, if there is a loss of objectivity of the instructors due to the chosen presentation techniques without their recognition, the statement given above would be totally misleading. In addition the fact that this process is done intuitively by each jury member, there is no possible way to analyze directly and separately this parameter.

One of the main aims of this study is to see if there is a relation not between the quality of the usage of chosen presentation techniques and the grades, but the chosen presentation technique and the grades directly due to the loss of objectivity of the instructors affected by the issues mentioned in the previous section. For these reasons, after the questionnaires are completed and results are collected, a reverse correlation analyze is used to check and see if there is an evident relation of the grades and the chosen presentation techniques. Five correlations are checked by factor analyses to see the relations between each successful grade ranges (100-90, 89-80, 79-70, 69-60, and 59-50) and the presentation techniques. One additional correlation analysis is made to see the relation between design studio and graduation studio grades and validate these separate correlations.

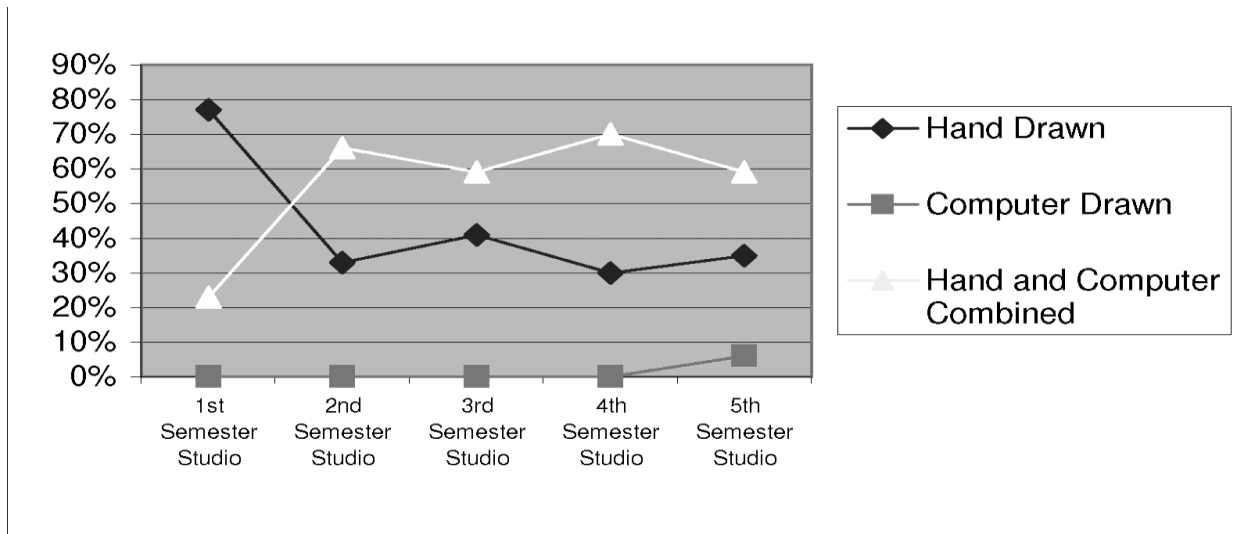
Similar to the classification by [8], the presentation techniques are grouped into three categories: 'hand drawing and rendering' (HDR), 'computer drawing and rendering' (CDR) and 'combined hand and computer drawing and rendering' (HCDR) in analyzing both the results of the questionnaires and the final grades of the presentation techniques. As noted in the previous study [8], sub-dividing the latter group is necessary for more detailed inquiries. Accordingly, in addition to the question on the overall usage of technique(s) for the presentation projects, every student is asked separately what techniques he/she has used on the plans, sections, elevations, details, perspectives, models and other contents. This approach helped to differentiate whether they used hand and computer applied techniques on the 'same piece of drawing' or 'separate sheets of drawing' in the same project. Furthermore, it also helped to see in which parts of the projects these techniques became prominent.

In the questionnaire, the students that prefer computer aided presentations were also asked which type of techniques they use, in order to evaluate their advancing levels of computer use in interior architectural design. This classification is taken from [25] where they classify these levels in three groups: basic, intermediate and advanced levels. Within this classification, the basic level of computer use includes digital design media, the intermediate level of computer use includes geometrical modeling and rendering, digital media drawing, structural analysis, digital moviemaking and animation, computable of design and spatial simulation techniques while the advanced level of computer use includes computer aided manufacturing and robotics, digitalization of the third dimension, laser surveying and photogrammetry, performance simulation, digital technology and communications, computation and construction, geographic information systems and spatial and data analysis methods.

## **Findings**

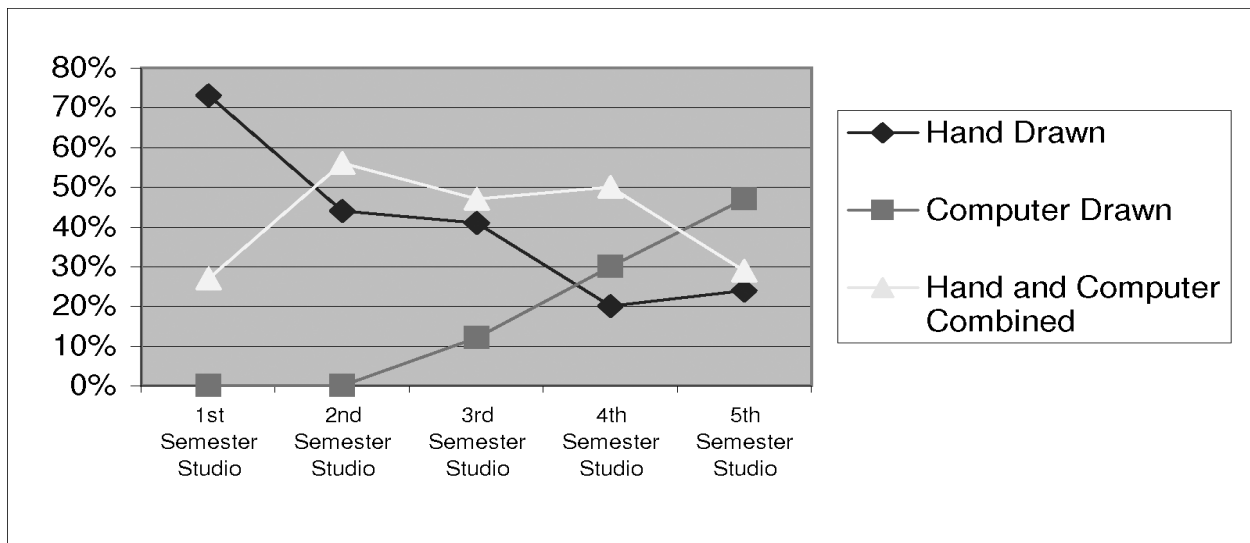
### **Results of the questionnaire with the students**

Within the students' questionnaire, the students were asked what drawing techniques they were encouraged to use during their whole design education. While 49% of the students responded HDR, 50% responded HCDR and 1% of them responded CDR, the ratios by studio semester differed as shown in Figure 2.



**Figure 2: Students responses to the question of encouraged drawing technique during their design education by every studio semester.**

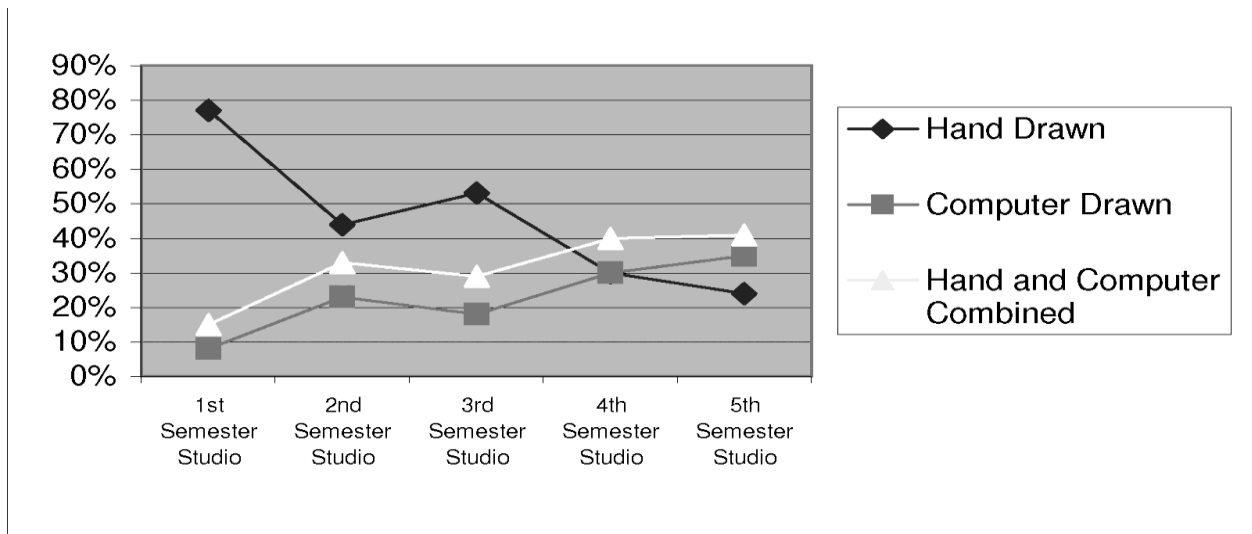
Taking into account the total number of students, when the students were asked what drawing techniques they were encouraged to use during their last semester studio, 46% responded HDR, 37% responded HCDR and 17% responded CDR techniques. Conversely, when the answers are analyzed chronologically for every studio semester, a drastic increase in the ratio of the CDR techniques and a decrease in the ratio of the HDR techniques are observed (Figure 3).



**Figure 3: Students responses to the question of encouraged drawing technique during their last semester studio by every studio semester.**

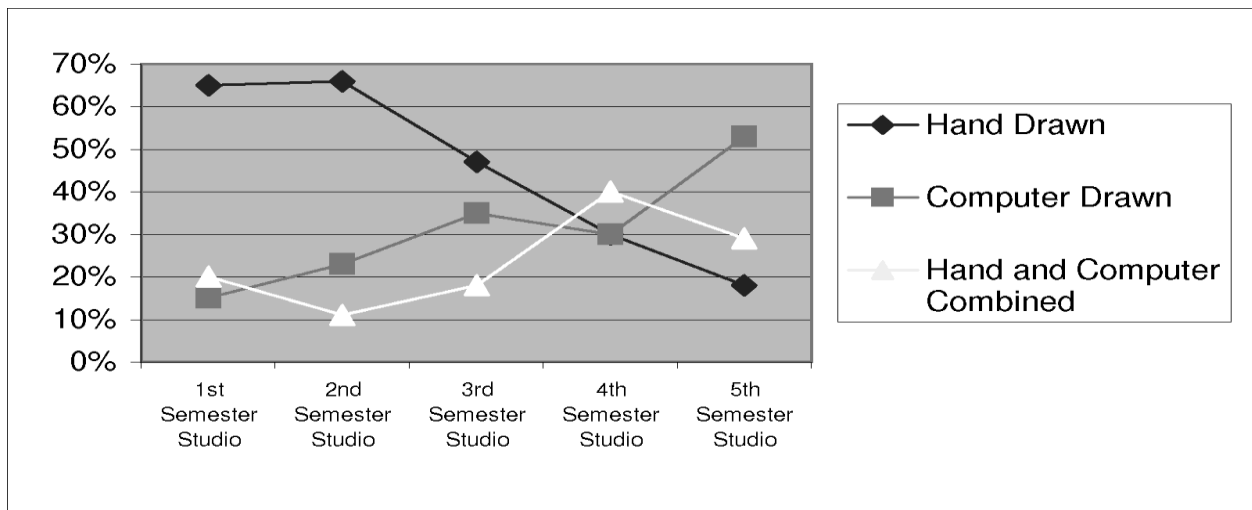
The students were asked what techniques they preferred during the design processes in their last semester studio. 51% responded HDR, 29% responded HCDR and 20% responded CDR techniques. When the answers are analyzed chronologically for every studio semester, it is

observed that there is a drastic decrease in the ratio of the HDR and there is an increase in the ratio of both CDR and HCDR techniques (Figure 4).



**Figure 4: Students responses to the question of encouraged drawing technique for design process during their last semester studio by every studio semester.**

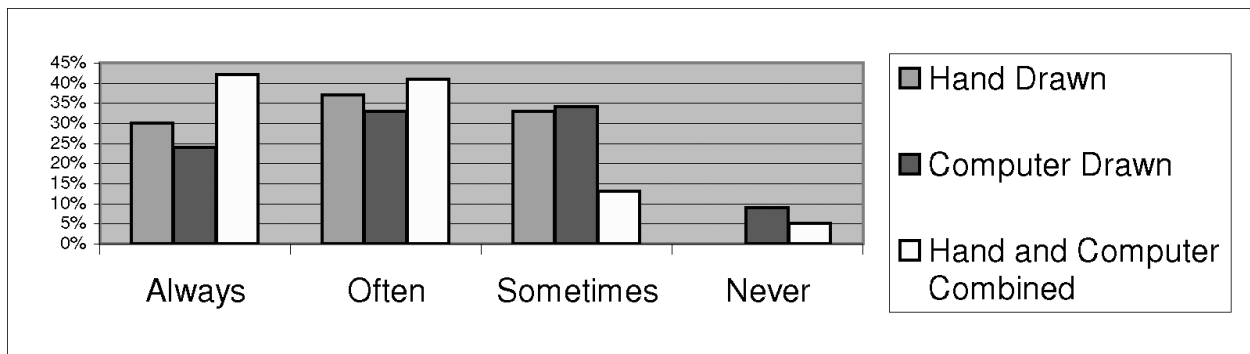
The students were also asked what techniques they preferred for their final presentations in their last semester studio. 47% responded HDR, 22% responded HCDR and 31% responded CDR techniques. The chronological analysis for every studio semester is shown in Figure 5 where the drastic decrease in the ratio of the HDR and the increase in the ratio of both CDR and HCDR techniques are visualized similar to the results in the prior questions.



**Figure 5: Students responses to the question of encouraged drawing technique for final presentation during their last semester studio by every studio semester.**

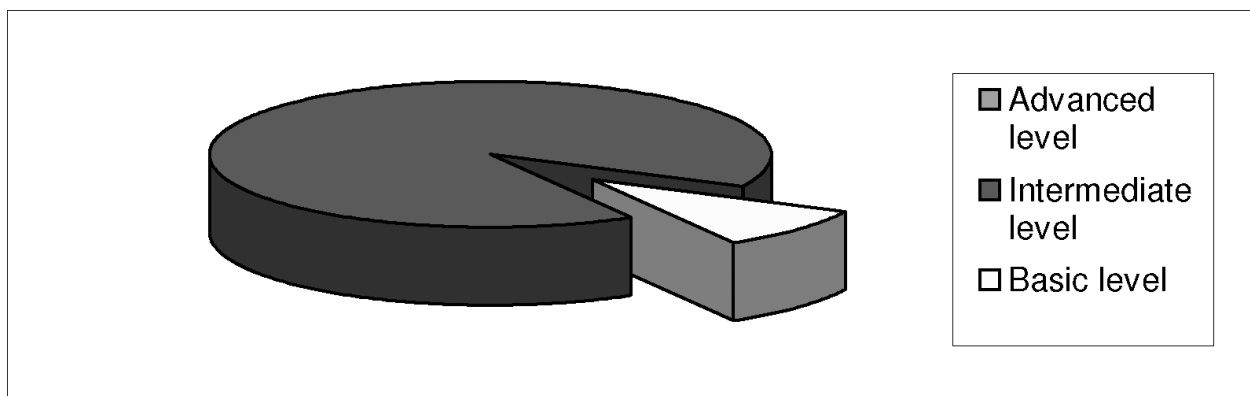


In the questionnaire the students were asked to which drawing techniques that they believed the studio instructors positively approached. While 30% responded that they believed the studio instructors positively approached to the HDR techniques, 5% responded they believed the studio instructors positively approached to the CDR techniques and 18% responded that they believed the studio instructors positively approached to HCDR techniques. Almost the half of the students (47%) responded that they believed ‘there is no significant distinction. When the answers are analyzed chronologically for every studio semester, no significant alternation can be visualized. Students were asked whether the issue of authenticity was implied or declared during the final presentation. The results are shown in Figure 6.



**Figure 6: Students responses to the question on whether the issue of authenticity is implied or declared during final presentation.**

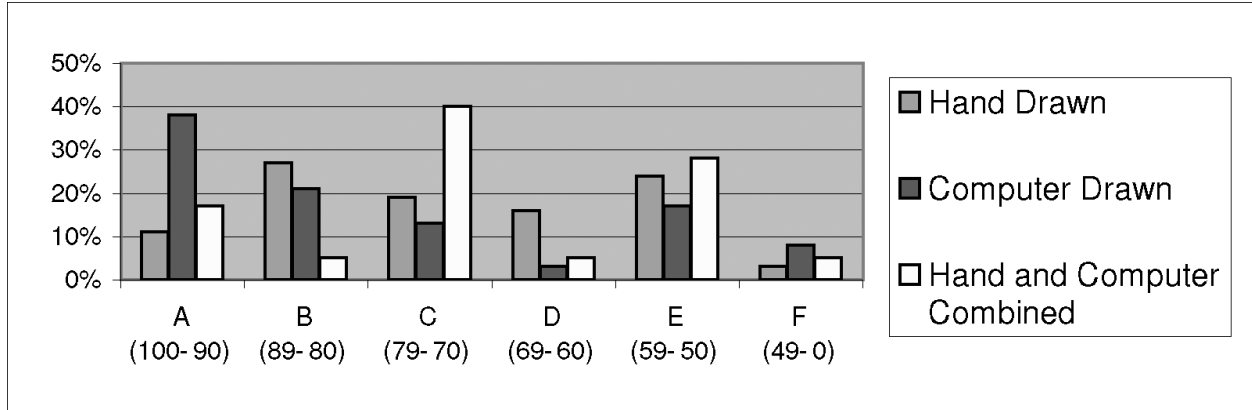
As mentioned in the previous section in the questionnaire, in order to evaluate the students’ advancing levels of computer use in interior architectural design, the students that preferred computer aided presentations were also asked which techniques they used. Distribution of the students’ levels according to [25] classification is shown in Figure 7. As seen in this distribution they are mostly at the intermediate level whereas only few of the students are at the basic level and none of them are at the advanced level.



**Figure 7: Students’ advancing levels of computer use in interior architectural design.**



In addition to these questions above, an additional question was asked to the students about the association between the presentation techniques and their final grades. The grade average of all students is 71.9 over 100. The grade average of the students that use HDR, HCDR and CDR in their presentations is 58.8, 70.3 and 77.0 over 100, respectively. In Figure 8, final grade distributions for each technique are shown. The results of a more comprehensive correlation analysis will be presented at the end of this section but the parallel increase of the design studio student average grades with the usage of computer in the presentations is noteworthy.



**Figure 8: Students' final grade distributions for every technique.**

**Results of the questionnaire with the instructors**

Within the instructors' questionnaire, the instructors were asked to which presentation techniques that they positively approached. Majority of the instructors seemed to prefer HCDR techniques, while few of theinstructors preferred CDR and none preferred HDR techniques (Table 1). Concerning the problems on identity and authorship, the majority of the instructors preferred either HDR or HCDR techniques whereas only one among all preferred CDR techniques (Table 1).

**Table 1: Instructors' responses to the questions related to the preference of presentation technique and potential of the technique in reflecting author identity, authorship and being familiar to the instructors**

	Preference	Identity, Authenticity and Proficiency
HDR	0	4
CDR	2	1
HCDR	10	5
No significant distinction	0	

In the study carried out with the instructors, it appears that all instructors agree that the students’ preferences of drawing techniques which they have most experienced will directly affect their success on final presentation’ evaluation (Table 2). On the other hand there is no compromise on which presentation technique should dominate the education (Table 2). Almost half of the instructors preferred that students primarily needed to be equipped with hand drawing skills in their education and the remaining half preferred that students primarily needed to be equipped with computer drawing skills in their education. Yet again majority of the instructors agreed that neither HDR nor CDR presentation techniques dominated the professional life (Table 2). They all stated that both techniques have points where they stood out with their own advantages.

**Table 2: Instructors’ responses to the questions related to the effect of students’ experience of drawing techniques to their success ratio, preferred drawing technique to dominated education and professional life and views on near future position of presentation media**

	Proficiency of the techniques students use is directly related to their success	Priority of hand drawing/presentation skills in education	Priority of computer drawing/presentation skills in education	Priority of hand drawing/presentation skills in profession	Priority of computer drawing/presentation skills in education	Preservation of the value of hand skills	Computer drawing/presentation will dominate in the near future
Agree	12	5	5	1	2	6	1
Not sure	0	1	1	2	1	3	2
Do not agree	0	6	6	9	9	3	9

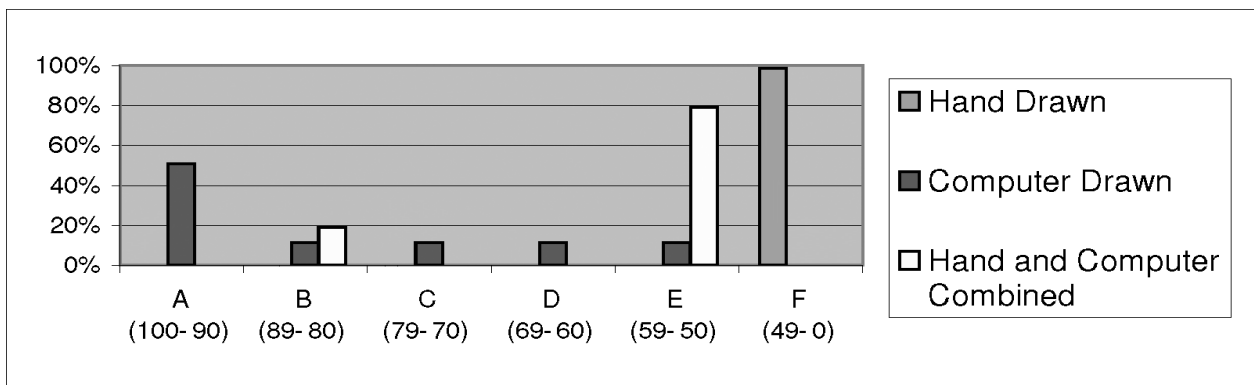
Table 2 illustrates that only half of the instructors think that in the near future HDR techniques will preserve their value. The remaining half either disagrees with or is not sure about this statement. The majority of the instructors disagree that CDR techniques will dominate in the near future (Table 2).

**Results of the graduation studio analysis**

As mentioned in the previous sections an additional phase was also carried out to shed a fresh light on the discussion about the correlation between the presentation techniques and the final grades of the students. In this phase, both the presentation techniques and the final grades of

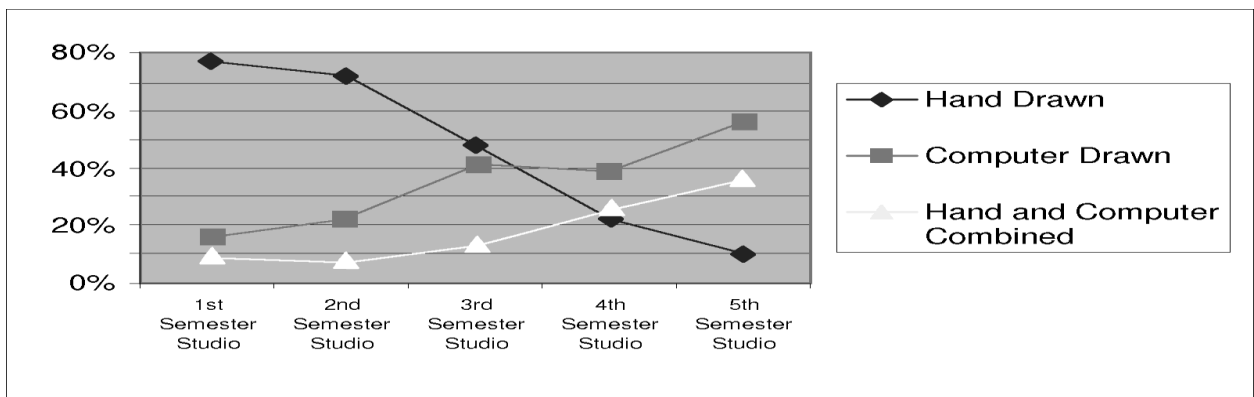
the students pursuing their graduation projects are collected and analyzed to check if there is a certain relation between these two parameters.

Among the students pursuing graduation projects, 8 students preferred the CDR technique, 5 students preferred HCDR technique and 2 students preferred the HDR technique. As illustrated in Figure 9, results almost visualize a polarized final grade distribution. The grade average of the total number of students is 66.6 over 100. The grade average of the students that use HDR techniques, HCDR techniques and CDR techniques in their presentations is 40.0, 58 and 78.8 over 100 respectively. Similar to the results of the design studio student average grades, the parallel increase of the graduate studio student average grades with the usage of computer in the presentations is also noteworthy.



**Figure 9: Presentation techniques and final grades of the graduation project students.**

To validate the results of the design studio students’ questionnaire on final presentation preferences (Figure 5), graduate studio students’ presentation technique preferences in previous design studios are asked. The results are shown in Figure 10. Similar to the results of the design studio students’ questionnaire, a drastic decrease in the ratio of the HDR and an increase in the ratio of both the CDR and HCDR techniques are visualized.



**Figure 10: Graduate studio students responses to the question of encouraged drawing technique for final presentation during their previous design studios by semester.**

## **Results of the correlation analyses**

The absolute value results of the first five correlation analyses made to see the relation between each successful grade ranges of 100-90, 89-80, 79-70, 69-60, 59-50 and the presentation techniques of HDR, HCDR and CDR, are 0.95, 0.26, 0.21, 0.93 and 0.63 respectively. The correlations between the first and the last two grade ranges, and the presentation techniques are clearly evident. The correlations between the second and the third grade ranges are under 0.50, so the correlations are not as clear as other ranges for these two ranges. According to these results it can be clearly stated that there is a proportional relation between the use of computers in the presentations and the student average grades.

Another correlation analysis is made to see the relation between design studio and graduation studio grades and validate these separate correlations. According to the grade average of the students that use HDR techniques, HCDR techniques and CDR techniques in their presentations presented in sections 3.1. for the design studio and 3.3. for the graduation studio, the correlation analysis result is 0.98 which is a very clear evident of relation between the grade ranges and the presentation techniques.

## **Discussions on the subject and conclusion**

According to the results of this study instructors mostly preferred HCDR techniques. They also preferred HDR or HCDR techniques for a solution to author identity and authorship issues. Most of them believe that the problems on authenticity, author identity and authorship will be solved if HDR techniques participate in students' presentations.

On the other hand instructors participating in this study did not compromise on which presentation technique should dominate the education. The only point they agreed was the reason for this conflict. They agreed that none of the techniques dominated the professional life. Only half of the participating instructors believed that HDR techniques would preserve their value in the near future. This approach will be another reason for this conflict.

In accordance with the results of the questionnaire carried out with the students, the students believe that they are mostly encouraged to use HDR techniques both during their last semester studio and during their entire education. But on the other hand when the results are analyzed for every studio semester chronologically another interesting alternation in their point of view is observed. A drastic increase in the ratio of the CDR technique can be visualized. This result is also confirmed by the questionnaire carried out with the graduate studio students. They tend to use computers more commonly both for the design process and presentations. This change will be reasoned by the ascending computer knowledge of the students gained by the courses related with computer education in the curriculum. Another motivation will be their ascending professional life experience by the help of the internship and training courses. Also computer aided design systems' advantages in mastering the complexity will be another reason for preferring these techniques in latter studio semesters.

The study exposed another misleading prejudiced opinion of the students. According to the questionnaire, many of the students think that design studio instructors positively approach to only HDR techniques. In fact according to the questionnaire carried out with the instructors, majority of them positively approach to HCDR techniques.

The students participating in the study and using CDR techniques for their presentations mostly use computers at the intermediate level and few of them use computers at the basic level. None of them use computers at the advanced level. These results show that advancing level of the students may be satisfactory for now but may be insufficient in the near future. According to this determination, a necessity to reorganize computer aided design education curriculum will arise in the near future.

It is a well-known fact that during the project evaluation process, not only the qualities of the usage of chosen presentation techniques but also many factors are involved, systematically or intuitively. It is not the purpose of this paper to disregard other evaluation criterion however one of the main aims of this study is to see if there is a relation -not- between the quality of the use of chosen presentation techniques and the grades, but the chosen presentation technique and the grades directly due to the loss of objectivity of the instructors affected by the issues mentioned in the first section. While majority of the instructors say that they positively approach to HCDR techniques, the analysis of the final grade distribution for each technique displays another fact. The mean value of the CDR presented projects' grades is the only mean value over the average of the whole students and average grade of the CDR presented projects are much greater than both HDR and HCDR techniques used projects. Also majority of the graduation project students prefer CDR techniques and their grades are clearly greater than the students that use the other techniques. Also according to the major correlation results of the factor analyses that are very near to 1.00, showing a clear correlation between the chosen presentation techniques and the student average grades, it can be stated that the instructors not only objectively evaluate the quality of the usage of chosen presentation techniques, but also are notably vulnerable to be affected by the chosen presentation techniques itself, especially by CDR.

These results arise some major questions for the design education community to discuss: Do the successful students prefer CDR techniques more often? Are the CDR techniques more prosperous to express design ideas? Or are the instructors that have insufficient knowledge of CDR techniques affected more easily to lose objectivity over against the projects that are presented with these techniques? As stated in [8] study it can also be assumed that academia does not seem to want to leave the romantic touch of the HDR techniques. But if the doubts that cause these questions are real, how should the evaluation process be adapted in order to keep in step with the digital age where new design and presentation techniques rapidly evolve.

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