

## Artículo de investigación

**A Research on Landscape Architecture Student Use of Traditional and Computer-Aided Drawing Tools**

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**Written by:****Simge Bardak Denerel<sup>161</sup>**

ORCID: 0000-0002-5241-9511

**Tanay Birişçi<sup>162</sup>**

ORCID: 0000-0002-6851-9605

**Abstract**

**Objective:** This study includes a survey study on the effectiveness of the landscape design process of traditional and computer aided drawing tools by landscape architecture students. The research hypothesis, the traditional drawing tools in the process of landscape design, continue to be used in certain parts of the process. However, the computer aided drawing tools are currently used more effectively and more frequently.

**Materials and Methods:** In order to test this hypothesis, a questionnaire was applied to the students of the department of landscape architecture. In order to reveal the effectiveness of drawing tools in the design process, a total of 111 landscape architecture students took part in a survey which included 68 questions. As a result of the survey, students' attitudes towards drawing tools were revealed. The questionnaire consists of 21 multiple-choice question, 5 open-ended questions, and 42 questions on the ranking positive sentences by degrees. The data was evaluated using SPSS program (version 15.0). Man-Whitney U and Wilcoxon tests were applied in order to compare the two drawing tools according to the data of the 5th and 6th chapters and to reveal the differences in preference to gender discrimination.

**Results:** The survey participants consisted of 72 females (64.9%) and 39 males (35.1%) students. The majority of the respondents with 53 people were from the third year, 5<sup>th</sup> semester students. Determining in which stages of the design process, which of the drawing tools they prefer to use. As a result of the survey, it was found that 91% of the students were more positive about computer aided drawing tools.

**Conclusion:** According to the results of the survey, it is certain that the computer aided drawing tools are considered more favourable. However, 92,8% think that traditional drawing tools and computer aided drawing tools can be used together during the student design process.

**Key words:** Traditional drawing tools, computer aided drawing tools, landscape architecture, education of design, design process.

**Introduction**

Drawing tools play a very important role in solving the design problem. The only way for the designer's thoughts to reach a physical reality is with the use of drawing tools. With the changes in technology and design, the use of drawing tools has also changed and improved. Previously

only *traditional drawing tools* were used, nowadays *computer-aided drawing tools* are also being used and positive changes are observed for the solution of the design problem. The development of drawing tools has moved forward with computer aided drawing tools and

<sup>161</sup> Assist. Prof. Dr. Simge BARDAK DENEREL, Near East University, Faculty of Architecture, Department of Interior Design, Nicosia.

<sup>162</sup> Prof. Dr. Tanay BİRİŞÇİ, EÜZF Department of Landscape Design, 35100 Bornova, İzmir.

has come to the present day proving ease of reaching to the solution, shortening of the drawing process, more comfortable perception of details, ease of archiving and modelling, and similar effects. After the 1960's computer aided drawing tools began to be used rapidly in every field, and with the introduction of the computer in landscape architecture, visuals that had never been seen in the design problem solution began to emerge (Küçük, 2007). Computer-aided drawing tools offer some amenities that traditional drawing tools cannot offer to the designer and play a significant role in the landscape design process. However important the use of drawing tools in the landscape design process are, the more important it is in landscape design learning. The best way for the student to express their thoughts is only through the use of drawing tools. The design process, which started with the use of traditional drawing tools, usually reaches the final with the use of computer-aided drawing tools. Design process; It is the period from the initial formation of the design idea until it reached a solution. The most important element to be examined in this portion is the way designers use drawing tools. As in many occupational disciplines working in planning and design, the use of computers in landscape architecture is increasing its effectiveness. Computer-aided drawing tools, an alternative to traditional drawing tools used from past to present, offer new possibilities to the designer. These new possibilities impress the design process. This study aims to investigate the new role of traditional drawing tools and computer aided drawing tools in the design process. The use of computer in the design phase has caused controversy. As a result of these debates, two different expressions have emerged as **traditional drawing tools** and **computer aided drawing tools**. In the field of landscape architecture, the use of computers has an important place in both education and professional field. In this study, the effect of traditional and computer aided drawing tools on student projects is investigated and aimed to show their effectiveness in landscape design process is aimed.

### Material and method

The questionnaire was applied to students of the 3<sup>rd</sup>, 4<sup>th</sup> grade and higher education in the Department of Landscape Architecture. A total of 111 students from 3<sup>rd</sup> and 4<sup>th</sup> grade and Master students were surveyed.

During the preparation of the questionnaire, literature of the subject to date, has been

reviewed and various scientific studies have been utilized. The doctoral dissertation of Küçük (2007) was used in the preparation of the E and F sections of the survey.

The survey consists questions including of 21 multiple-choice, 5 open-ended and 42 positive sentences sorted by rank.

The survey was conducted in the fall of 2009-2010 period and the data were evaluated by using SPSS program (version 15.0). Man-Whitney U and Wilcoxon tests were applied in order to compare the two drawing tools according to the data of the 5th and 6th chapters and to reveal the differences in preference to gender discrimination.

**Man-Whitney U test:** It is used in scientific studies where the distribution of scores does not meet the assumption of normality in experimental studies involving unrelated measurements. The Man-Whitney test determines whether the scores obtained from two unrelated samples differ significantly from each other (Geçe, 2012).

**Wilcoxon test:** An analysis method used to test whether the distribution of the two variables is the same, taking into account the dimensions of the differences between the paired groups. It is the non-parametric equivalent of the T test, testing whether there are random samples drawn from n-unit samples.

The questionnaire consists of 7 sections

- *A-General Parameters*
- *B- Parameters of the importance of Computer Aided Drawing Tools rankings*
- *C-Parameters Related to the Use of Drawing Tools in the Landscape Architecture Design Process*
- *D-Parameters related to learning of Drawing Tools in the Landscape Architecture Learning Proces*
- *E-Parameters Related to the Use of Traditional Drawing Tools in Landscape Architecture Design Process*
- *F-Parameters of Computer Aided Drawing Tools in Landscape Architecture Design Process*
- *G-Parameters of Using Both Drawing Tools to Solve Landscape Architecture Design Problem*

## Research findings

### Literature Summary

#### Drawing Tools

Drawing tools to be used in the design process is a special case that varies according to the preference of the designer. *'The best approach is to identify and use the tool required for each phase of the work'*. There are no rules as to which stages these tools will be used (Howard, 1993). The only way the designer can show his or her thinking is by using drawing tools. In this context the research on how landscape architecture drawing tools are used with changing technology is of great importance.

**Traditional drawing tools:** In the process of finding a solution to the design problem an abstract paintings of the design occur primarily in the designer's mind (Balta, 1999). However, the greatest difficulty faced by the students who are just beginning to study architecture is to interpret and visualize the spatial relations with the product they designed during the architectural design process. The first step the student has to take is to show the forms they have visualized in their minds using traditional tools such as paper, pencil or a model. Illustrations; are divided into three parts as concept illustrations, rough plan illustrations and technical illustrations. Drawing tools; compasses, ruler, T ruler, various drafts, straight and circular templates, set squares, sketch paper, flexible curve ruler, roll copy paper, presentation paper, curved ruler, erasers, paper tape, dough eraser, utility knife, rapido, pencil and paper cleaning broom. In order to be able to use all this equipment, a lot of attention and hand skills are required (Mitton, 2003). 'Traditional expression techniques' Yıldırım et al., (2010) made using traditional drawing tools on two-dimensional drawings on paper, three-dimensional drawings: perspectives and three-dimensional models.

**Computer-aided drawing tools:** Up to 25 years ago, almost all drawings were made on paper with a pencil. Small changes were made by deleting and redrawing whereas, large changes often meant redesigning the drawing. Computer-aided drawing tools have fundamentally changed all these operations (The History of Cad, 2011). All these processes during the design process affect the design speed of the designer. The computer speeds the students time used for drawing, increases the time devoted to the design and enables the changes to be made on the drawing easily. 'Expression Techniques'

Yıldırım et al., (2010) made using computer-aided drawing tools explained as follows: Two-dimensional drawings, drawings (plan, section, views), three-dimensional models, modelling, animation and photorealistic images. In their definition of visualization, Goldermens and Hoogenboom (2001) stated that "transforming a spatial object into two- or three-dimensional models that can be perceived by the human mind after design, application and after application" (Bardak, Birişçi, 2017). Visualization software; due to its advantage such as being fast, low cost, easy to be stored, can be revised, can be drawn with zero margin of error and easy to be produced for alternative solution proposals, are preferred (Uğur and Özgür, 2003, Yıldırım et al., 2010: 21).

#### Survey study

The questionnaire was applied to 111 students from 3rd, 4<sup>th</sup> grade and Master students and their approaches to drawing tools were investigated. The questionnaires were completed in approximately 30 minutes. The survey participants consisted of 72 female (64.9%) and 39 male (35.1%) students. The majority of the respondents consisting of 53 students were third grade students. According to the results of the survey, 96.4% of the students have their own computers. While the majority of the respondents (71%) have been using computers for 6-10 years, about one fourth of them have been using computers for 5 years. The number of newly introduced students is quite low (3%).

In the second part of the survey, which computer programs students prefer to use was investigated. The students were asked to sort the programs they used according to their characteristics. As a result of ranking; The most commonly used computer program: AutoCAD, the easiest computer program: SketchUp, the fastest computer program: AutoCAD, the best image quality computer program 3d Max and the most preferred computer program was determined as AutoCAD. In the third part of the survey, questions were asked to determine which drawing tools they used at which stages during the design process. The idea of using traditional drawing tools (35%) was found to be more effective than the computer aided drawing tools (8%) in the stage of research and concept formation. In addition, 53% of the students prefer to research and create concepts using both drawing tools together. It is seen that 42% of the students preferred the traditional drawing tools during the sketch studies which starts the design process. At this stage, computer aided drawing

tools take the second place with 32% and 1/4 of the students who participated in the survey stated that they used both drawing tools together. In the two dimensional studies that started after the sketch studies, students used traditional drawing tools at a very low rate of 7%, while 55% preferred computer aided drawing tools. A group of 38% of students prefer to use both design tools together. A significant proportion of 78% students prefer computer-aided drawing tools in the three-dimensional drawing stage. 21% of students prefer to use traditional drawing tools and computer aided drawing tools together.

The proportion of students who chose to use traditional drawing tools in the three-dimensional drawing phase remained only 1%. At the end of the design process when the work for the presentation and final started, 75% of the students prefer to use computer aided drawing tools. Only 2% of students prefer to use traditional drawing tools. Nowadays, according to the results of the survey, a large group of students a proportion of 80% choose computers in the landscape design process (Figure 1)

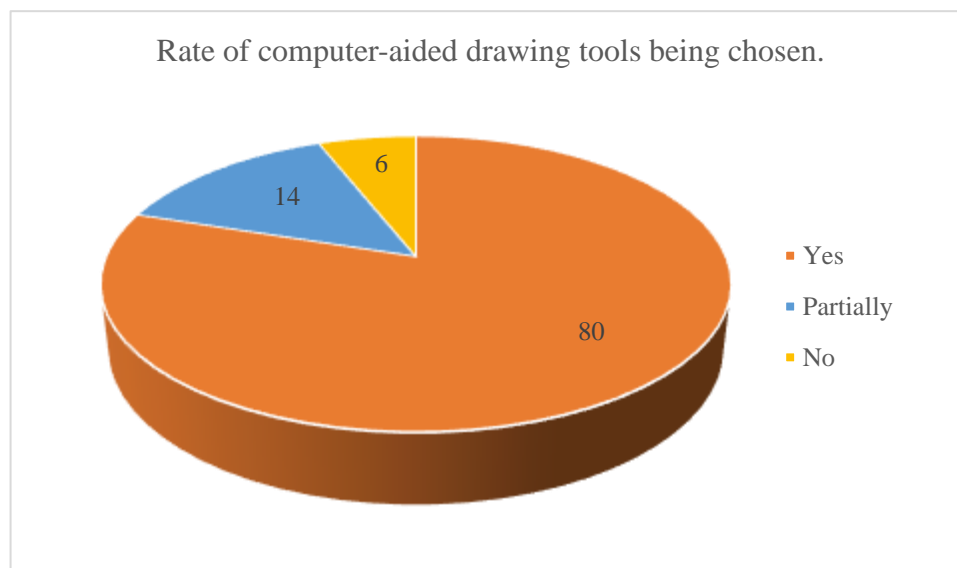


Figure 1. Rate of computer-aided drawing tools being chosen.

Only 50% of students are considering using traditional drawing tools in the future. According to the other parameter, the majority a rate of 97% thought that they will use computer aided drawing tools in the future. 98% of the students think that the use of computer-aided drawing tools should be taught as a subject during the 4-year education period. 85% of the students think that the lessons given about computer aided drawing tools in 4-year education period is insufficient.

In section 4 information about the drawing tools used for learning in the landscape architecture learning process was trying to be reached. There is no separate course on learning traditional drawing tools in design departments in universities. In the questionnaire within the scope of the survey when we asked student 86% of stated that the use of traditional drawing tools

should be given as a course. While 98% of the students think that the use of computer-aided

drawing tools should be taught as a course during the 4-year education period, only 2% of students say that the use of computer-aided drawing tools should not be taught as a course. 51% of the students think that the use of computer-aided drawing tools should start in the first grade, 43% think that they should start in the 2nd grade and 5% think that the learning should start in the 3<sup>rd</sup> grade. Only 1% of students think that learning should start in the 4th grade.

In the 5th and 6th sections of the survey, questions were asked about the use of traditional drawing tools and computer aided drawing tools in the landscape design process. Man-Whitney and Wilcoxon tests were applied in order to compare the two drawing tools according to the data of sections 5 and 6 and to reveal differences

in preference to gender discrimination. As can be seen in Table 1, as a result of positive sentences directed to students, the use of drawing tools, computer-aided drawing tools score was found to be 83.98% and traditional drawing tools score was found to be 64.76%. It is seen that the students have more positive views on computer-aided drawing tools.

In the Wilcoxon test applied to the survey results, the approach to computer aided drawing tools

was found to be statistically more positive in the 99% confidence interval ( $P < 0.0001$ ). 101 out of 111 students surveyed were more positive on computer-aided drawing tools and 7 students on traditional drawing tools. 3 students were equally positive about traditional drawing tools and computer aided drawing tools. In Table 2, two drawing tools were compared by gender. According to the Mann-Whitney test used to reach these results, it was found that there is no difference in preference between men and women.

Traditional drawing tools	64,76 ± 11,23
Computer aided drawing tools	83,98 ± 7,30

Table 1. Traditional and computer-aided drawing tools score indicator.

In order to compare the two drawing tools normality test took place, the data did not show normal distribution. In the Wilcoxon test results applied to the data that do not show normal distribution, the approach to computer aided drawing tools is found to be statistically significantly more positive ( $P < 0.0001$ ). 101

people out of 111 students surveyed were more positive than computer aided drawing tools, 7 students were more positive towards traditional drawing tools. 3 students are equally positive about traditional drawing tools and computer aided drawing tools.

	Traditional drawing tools	Computer aided drawing tools	P value
Woman (n=72)	65.18± 11.72	83.28± 7.32	<0.0001
Man (n=39)	63.97± 10.37	85.28± 7.20	<0.0001
Total (n=111)	64.76± 11.23	83.98± 7.31	<0.0001

Table 2. Score breakdown by gender.

According to Mann-Whitney test in which two drawing tools were compared according to gender, it was found that there was no preference difference arising from gender discrimination. These data were evaluated by applying Wilcoxon test. As a result, it was found that both sex groups significantly found computer aided drawing tools more positive. Among the 72 male students surveyed, 65 students found computer-aided drawing tools more positive, while 6 students found traditional drawing tools more positive. 1 student finds traditional drawing tools and

computer aided drawing tools equally positive. Among the 39 female students, 36 students found computer aided drawing tools positive, while 1 student found traditional drawing tools more positive. 2 students find both drawing tools equally positive. The advantages and disadvantages of using traditional and computer-aided drawing tools are now widely discussed. The students stated that they found important traditional drawing tools 59.5% and computer assisted drawing tools 86.5%. (Figure 2).

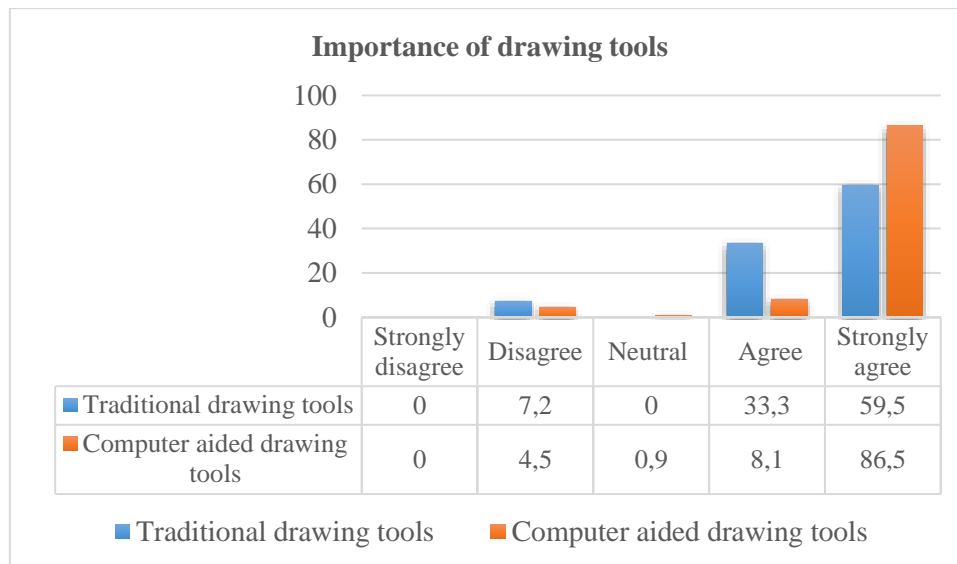


Figure 2. Importance of drawing tools.

The graph shows that both drawing tools can be learned (Figure 3). The students stated that the use of traditional drawing tools can be learned at a rate of 74.8%, while the use of computer-aided

drawing tools can be learned at a rate of 88.3%. It is a fact that the use of both drawing tools have their advantages and disadvantages.

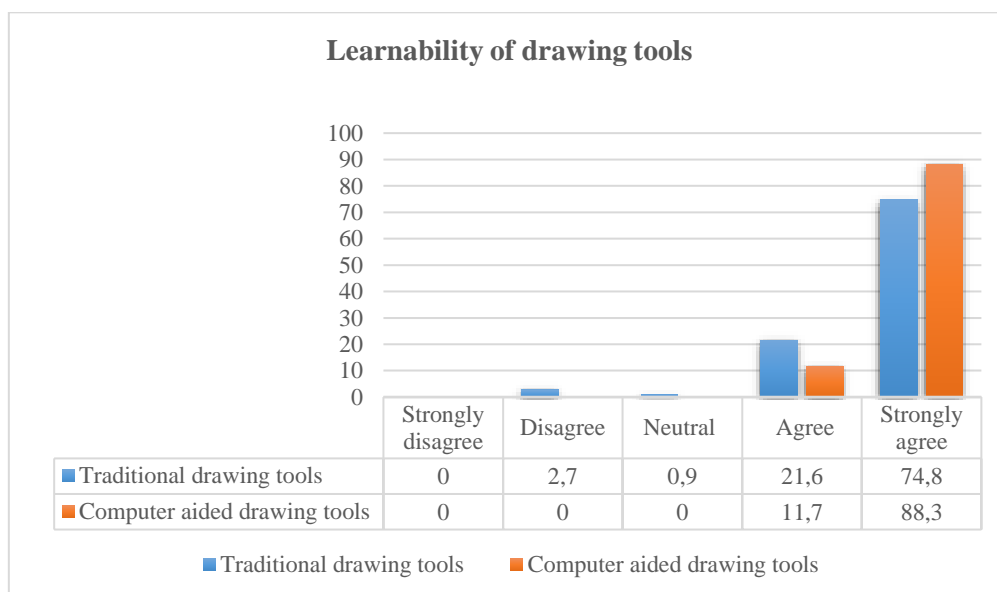


Figure 3. Learnability of drawing tools.

14.4% of the students with traditional drawing tools 21.8% with computer-aided drawing tools do not agree that they have disadvantages. As can be seen in Figure 4, participants partially agree

that 53.2% of the traditional drawing tools and 48.2% of the computer aided drawing tools have disadvantages. The participants who totally agree were made up of 16.2% in traditional drawing tools and 10% in computer aided drawing tools.

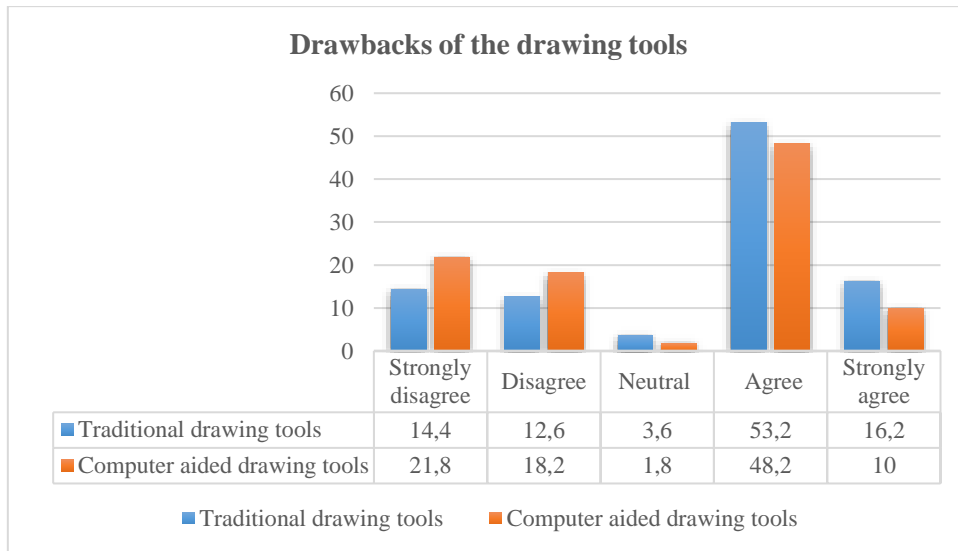


Figure 4. Drawbacks of the drawing tools.

At different stages of the design process, students' preference of drawing tools may vary. Considering the adequacy of drawing tools in two-dimensional drawings, the majority of students (72.7%) think that computer-aided drawing tools are sufficient in two-dimensional

drawings. 20.7% of students think that traditional drawing tools are sufficient. Besides these values, 44.1% of the students think that traditional drawing tools are partially sufficient in two dimensional drawings. (Figure 5)

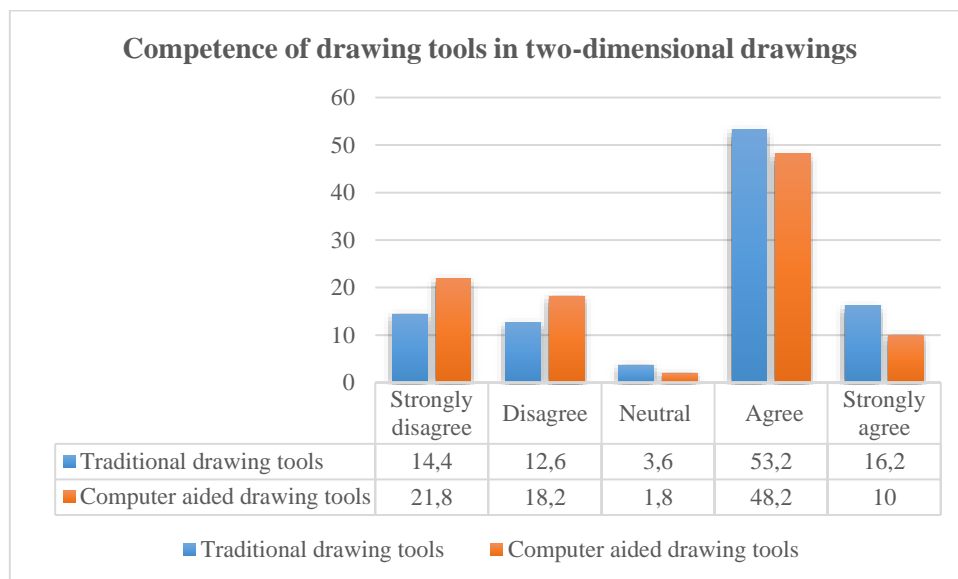


Figure 5. Competence of drawing tools in two-dimensional drawings.

While students found computer-aided drawing tools sufficient in three-dimensional drawings (81.1%), they found traditional drawing tools inadequate as seen in the first two columns

(Figure 6). However, computer-aided drawing tools are more favourable in creating alternatives (Figure 8).

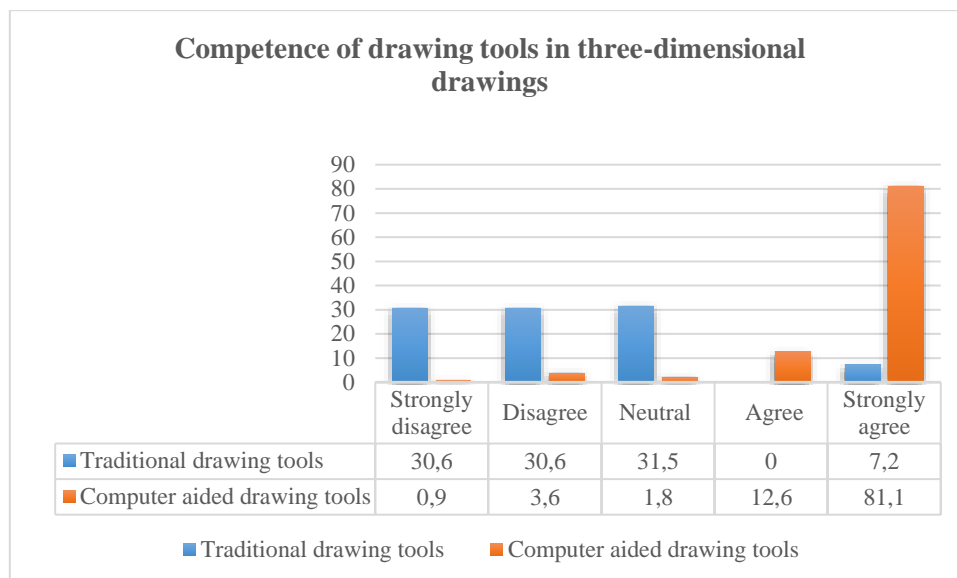


Figure 6. Competence of drawing tools in three-dimensional drawings. It is contemplated that both drawing tools can be used in the process of generating alternative solutions.

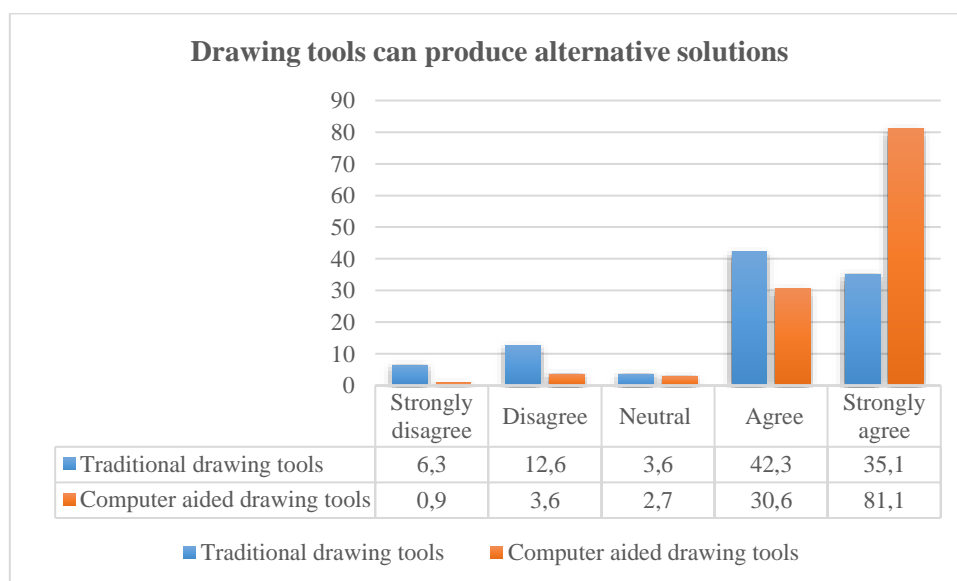


Figure 7. Drawing tools can produce alternative solutions.

The majority of students (51.4%) think that computer aided drawing tools start their designs faster (Figure 8).



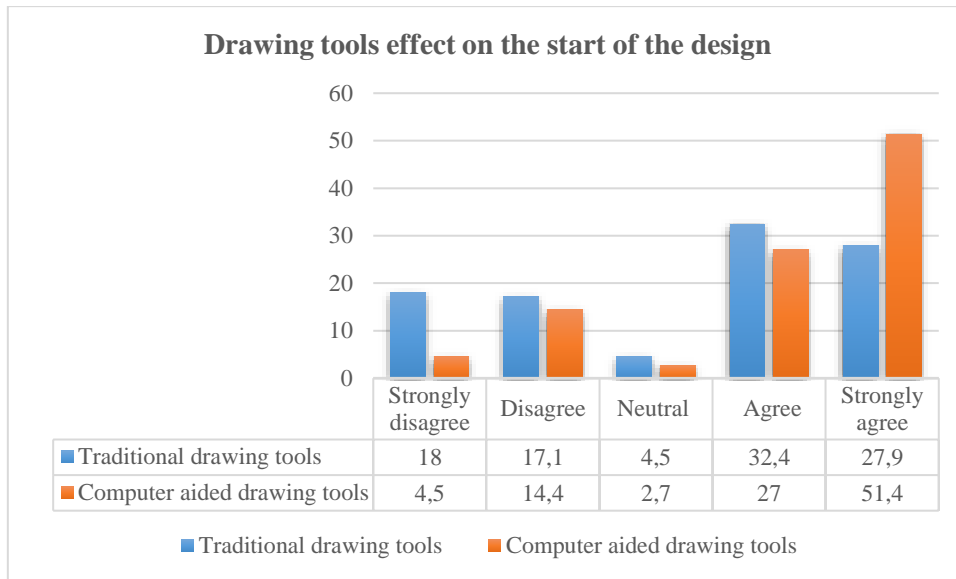


Figure 8. Drawing tools effect on the start of the design.

Students apply different drawing tools at different stages of design. When all phases of the design process are considered together, it is seen that students are more positive about the use of computer aided drawing tools.

When the effect of drawing tools on the design process is considered, it is thought that 51.4% computer aided drawing tools can change the design process. 40.5% chose partially agreed, on the statement that the effect of the traditional

drawing tools on the change of the design process.

Almost 3/4 of the students think that they can improve the design process by using the facilities provided by computer-aided drawing tools (70.3%), while some students are not quite sure but think that traditional drawing tools also contribute to the design process with 46.8% choosing the partially agree option.

It is seen that traditional drawing tools are used more in the early stages of design than computer aided drawing tools (Figure 9).

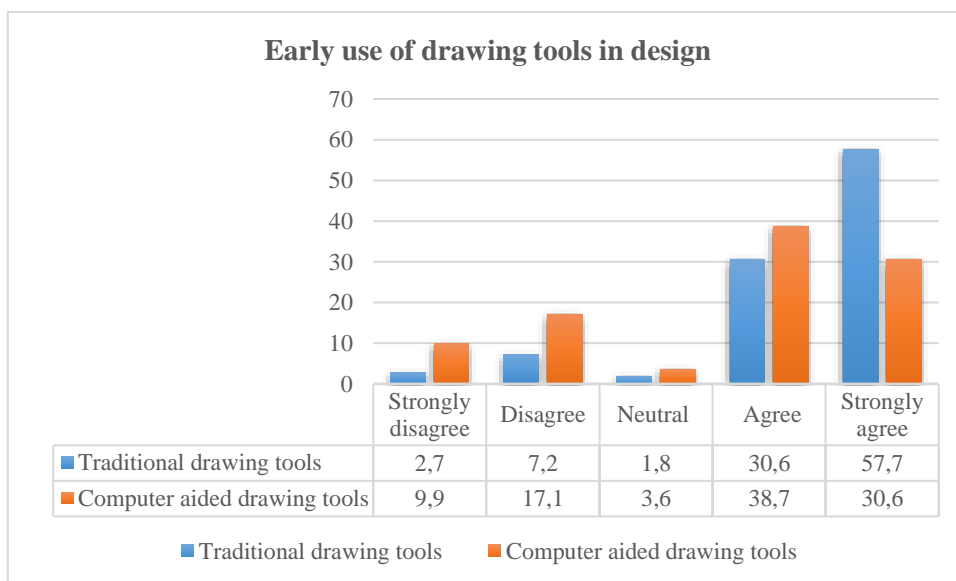


Figure 9. Early use of drawing tools in design.

Looking at the easy drawing of the product design with the use of drawing tools, it is seen that the product design is easier to draw by using computer aided drawing tools with a high rate of 77.5% (Figure 10).

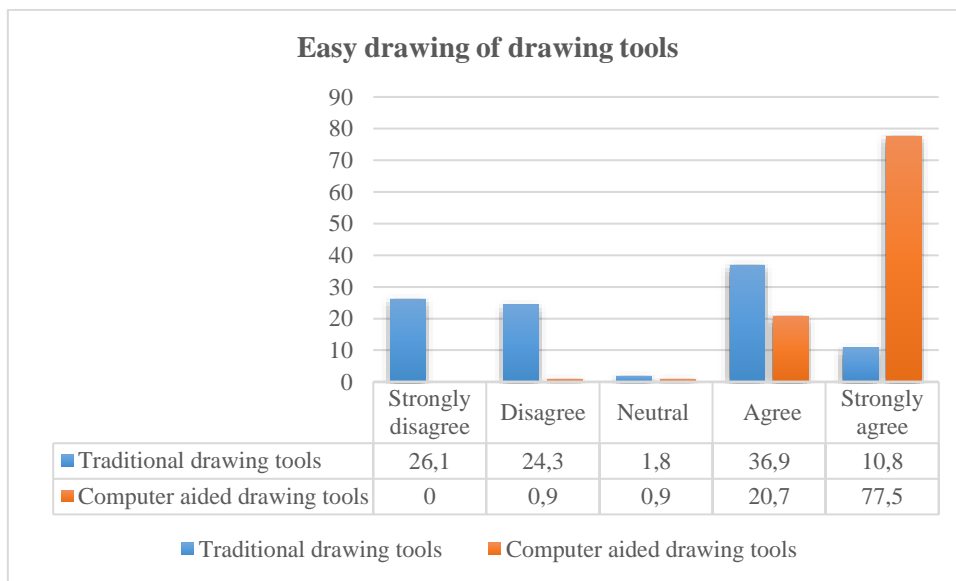


Figure 10. Easy drawing of drawing tools.

Students will be able to draw the design product faster by using computer aided drawing tools; it is thought that traditional drawing tools do not

contribute to rapidity of drawing (36.9%) (Figure 11).

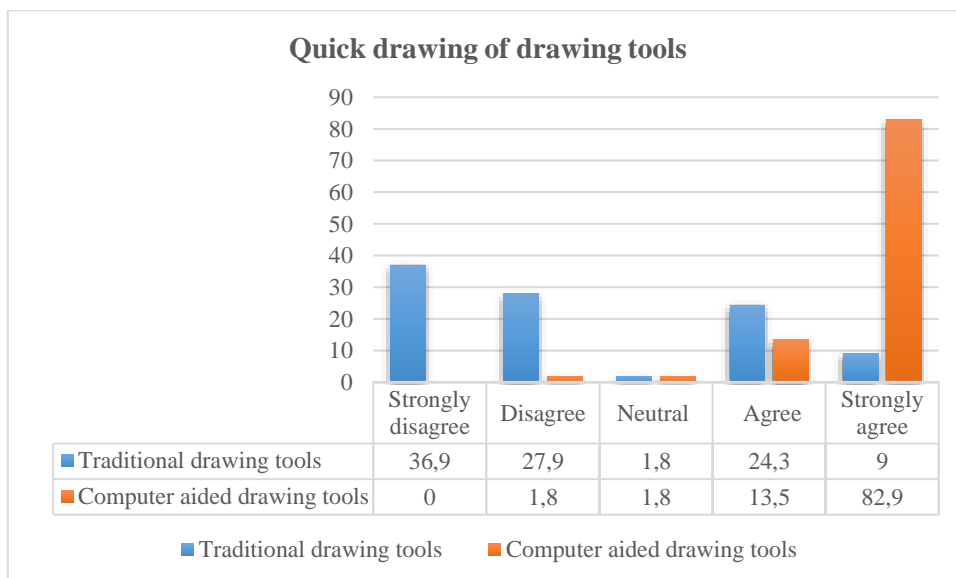


Figure 11. Quick drawing of drawing tools.

The advantages of computer-aided drawing tools in terms of design reorganization have come to

the forefront with a high rate of 81.1% (Figure 12).

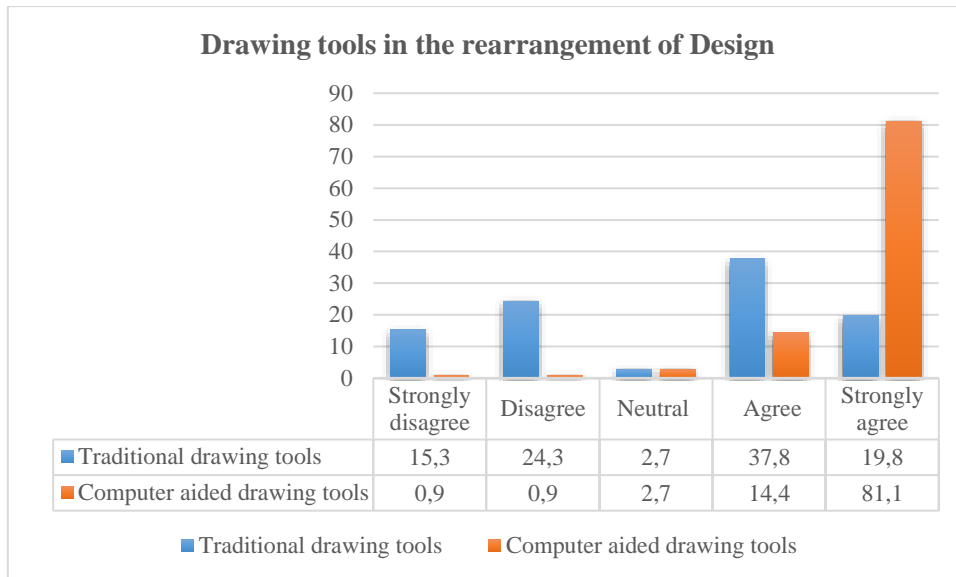


Figure 12. Drawing tools in the rearrangement of Design.

As it is seen in Figure 13, 87.4% of the students think that the design using computer aided drawing tools can reflect the visual reality.

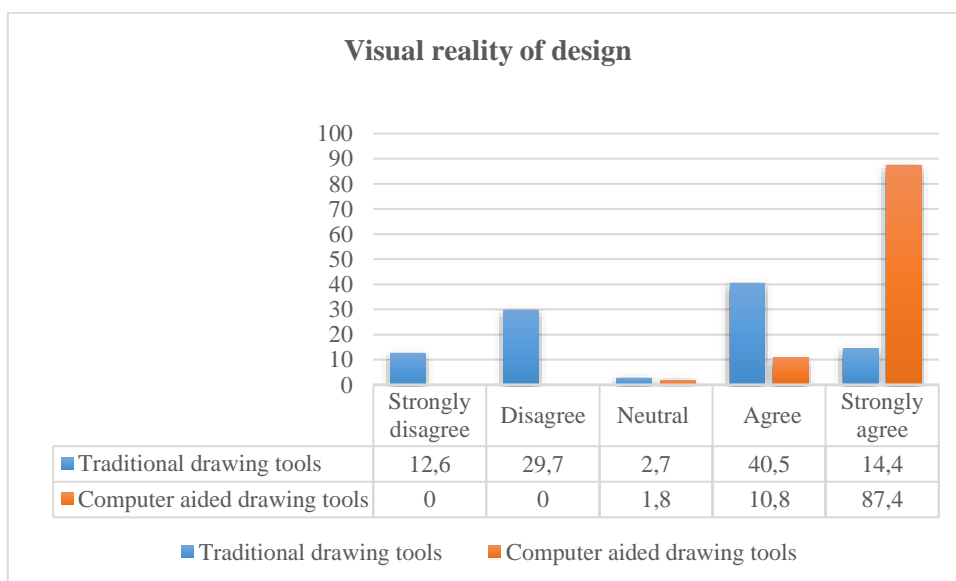


Figure 13. Visual reality of design.

The students think that the creativity value of drawing tools is equal. Questioning whether or not creativity is a role of drawing tools ‘Creativity value of drawing tools’ a majority, 9.5% students chose the option of totally agree.

However, as can be seen in Figure 14, the computer-aided drawing tools and traditional drawing tools have remained at an equal distance from the choices of partially agree and totally agree.

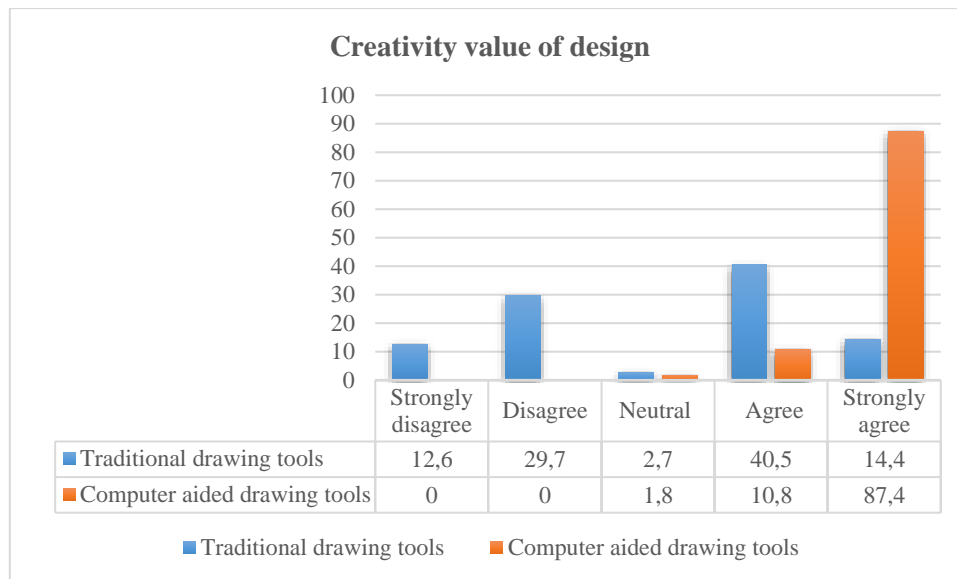


Figure 14. Creativity value of design.

Computer-aided drawing tools are advantageous at 88.3% when the product drawn by the drawing tools can be used in other media. Approximately half of the students think that the products obtained with traditional drawing tools can be partially used in other media.

It is seen that the use of traditional drawing tools alone is not sufficient (46.8%) in the formation of the design product. The use of computer-aided drawing tools alone is also not considered to be fully sufficient (29.7%), and even 47.7% is considered partially sufficient.

It is seen that the design which is drawn by using computer aided drawing tools is easier to archive and store with 89.2%.

Although most of the questions are more favourable to the use of computer aided drawing tools, 93% of agree that traditional drawing tools and computer aided drawing tools can be used together in landscape architecture design.

In the sketching stage of the landscape architecture design process, it is considered that 34% completely agree and 36% partially agree that drawing tools can be used together.

Throughout the study, it was found that the use of computer-aided drawing tools was more dominant than traditional drawing tools. At the presentation stage, the students agree that both drawing tools can be used together with a 67% fully agree response.

40% of students fully agree with the idea that both drawing tools can be used together in the future, while 28% of students partially agree with this idea.

### Result

Within the scope of this study, it was observed that the students of landscape architecture prioritized the computer aided drawing tools. Throughout the study, it turns out that each student has a unique process of using drawing tool. It was observed that students could use drawing tools at different times for different reasons.

The number of students (2%) who use only traditional drawing tools during the presentation phase is almost negligible. About 15 years ago, when viewed in university who provided architectural education in Turkey, the use of computer-aided drawing tools was almost non-existent.

It was found that the design stages of the students observed in the design process were not the same, and each of them had different preferences. It was observed that there was no gender difference with a statistical significance in the selection of design tools. Both gender groups find computer aided drawing tools more positive. The idea that computer aided drawing tools can improve and change the design process has emerged. The most important reasons for choosing computer-aided drawing tools are: Easy to be drawn, can be rearranged, can be drawn fast, start the design

fast, produce alternative solutions, and be easily used in other media. In the past years, design processed carried out using only traditional drawing tools, when looking at the present day does not mean anything by itself and is certainly not sufficient in the formation of the product design.

As a result of this study, it can be said that *'computer aided drawing tools are used more effectively in landscape design process.'*

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