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Article

Re-thinking group work in basic design education: A quantitative analysis of adapting exquisite corpse and decision tree approaches

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ABSTRACT

In design education, especially in the first-year design studio, different approaches ranging from artistic to analytical and abstract to concrete have been used. This paper attempts to study one of those approaches namely "Exquisite Corpse (EC)", which is an art-stemmed approach, employed in the architecture's first-year design studio. In addition, decision-tree (DT) approach was used, which like EC, requires dialogue among students and helps foster problem-solving abilities by giving more structure to the educational medium as well. This paper uses quantitative methods to analyse the design process in the search for distinct methodologies in design research. The main purpose of this article is hence to evaluate the use of EC and DT in basic design education and to provide empirical implications for the development of the basic design teaching methodology. Descriptive statistics and a Pearson's chi-square test of independence were performed to examine the relationship between students' use of the exquisite corpse approach and their grades. The paper highlights the need for distinct methods for the scientific analysis of design research. The analysis used in this paper provides scholarly information to other design educators in higher education. The initial aim is to incorporate EC and DT in the final project were to help novice designers in guiding their design processes better. The research model of this study can help exemplify analytic research for design-related disciplines for future research studies.

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INTRODUCTION

The basic design course of the first year is a pivotal course that helps students to solve design problems. In this course, a wide variety of approaches with epistemological and content differences have been utilised over space and time. These discrepancies relate on one hand to artistic-intuitive, and on the other to rationalistic-analytic perspectives of the educators. Also, within these applications, there have been significant differences in the levels of abstraction (abstract-conceptual vs. concrete-environmental).

Design education requires improvement and constant re-evaluation (Noël, 2020). Perspectives in design education continuously change such that the field requires further studies providing information and empirical evidence on

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the validity and success of such distinct methods in use. Also, the area of teaching and learning is argued to remain undocumented to the academic community (Antman and Olsson, 2007), which in fact could be useful for many if they were scholarly discussed in scientific environments. This argument is extended by using an empirical study for knowledge in the architectural design studio in the search to identify how architectural design studios deal with and teach the aesthetic aspects of architecture (Young Cho, 2013). As such, introducing our curriculum in basic design education and presenting the empirical findings of its effects is argued to be fruitful for many design scholars.

This paper attempts firstly to analyse the inclusion of an art-stemmed approach "Exquisite Corpse" in architecture's basic design course and evaluate its repercussions. "Exquisite Corpse" is a surrealist art perspective that was developed around the 1920s. Previously, Exquisite Corpse (EC) has been applied in design education in several other universities, at different levels.[1] Yet, all had distinct conceptualisations and therefore ended up in different results. In our case, EC was incorporated in the design problem to enable students to make intuitive decisions as a group.

Additionally, this paper deals with decision making processes of novice students. The design problem of the final project enforced students to develop Decision Trees (DT) where they picked from pre-determined sets of concepts. This enforcement aimed to clarify the choices groups make in their design processes. As such, decision trees might help to control design processes. In previous terms, formal algorithms (Sarıoğlu Erdoğdu ve Orbey, 2017) were rigorously used in the studio where students were asked to write down their design decisions step by step through their design processes. Hence, when compared to EC, DTs are attributing more to the rationalistic aspects of the design process.

Based on this context given, both approaches are then analysed by pure statistical approaches –namely, descriptive statistics and chi-square analysis. At the end of the semester, an online survey was distributed to the students to understand how students worked as groups in the basic design studio and to address the benefits of EC and DT in the design processes. Most of the questions aimed to enhance our understanding of students' managing design processes and to analyse the role of EC and DT in students' success. The empirical study of this paper relies on the findings of this survey.

BACKGROUND: DIFFERENT APPROACHES IN BASIC DESIGN EDUCATION

The basic design course is one of the key courses in Design Education where students are introduced to basic concepts of design and abstract thinking. Basic design course is one of the key courses in Design Education. In this course, students are introduced to basic concepts of design and abstract thinking. Basic design, in different curriculums, may be offered either as a separate course that supplements the design studio of the associated term or, as an individual studio course.[2] In the former and relatively less common option, it serves as a supporting course to the First Design Studio, which is the case for this study.

In basic design courses, paper-based design thinking, and analogue tools are dominant. However, digital technologies have been occupying design studios while bringing their own unique logical thinking ways and changing methodologies (Oxman, 2008) since the beginning of the 2000s. No matter with soft or hard media, the logic behind the course remains almost the same.

Basic design course had been first developed and implemented as a primary element of Bauhaus and Modernism in the 1920s, leading to significant changes in the related disciplines afterward (Sarıoğlu Erdoğdu, 2016), continued to innovate and influence globally (Droste, 2019). According to White-Hancock (2023), Bauhaus's educational philosophy integrates the hitherto disparate sectors of the arts, crafts, business, mathematics, engineering, and industry.

Also known as "Vorkurs", the foundation course was a framework in which the elementary study of form and material was introduced in the workshop through the hands-on activity of doing and making at Bauhaus (Ozman, 2008). It is also referred to as "The Basic Design Movement" which represented the dissemination of educational ideas of Bauhaus against the Impressionist realism of the era (Yeomans, 1992). Inherited from Bauhaus, where Modernism was a pedagogical model (Oxman, 2008), apprenticeship relations are utilised which means students learn from peers and implement what they have grasped so far. The teachers be referred to as "masters" and the students as "apprentices" and "journeymen", eliminating the academic term "professor" (Lerner, 2005). Such a pedagogical approach is widely known as "learning by doing" and is applied in design studios to a great extent, including basic design course. This method allows the designer whether novice or senior to explore the alternatives so that design decisions can successfully be made depending on those trials and errors. Further, the activity of learning in this method is more lasting than a didactic process, as the students engage actively in the process and would more probably remember their personal experiences in the long run.

Depending on the ontological position of the University and the instructors, a variety of different perspectives could be employed in this course (Sarıoğlu Erdoğdu, 2016). Among a bulk of basic design approaches, the first difference stems from *an art/science point of view*. This is an epistemological difference that has already been shaping the discussions

around art and architecture across time and space. Another difference depends on a distinction on the *abstract-concrete level of the course* which also has repercussions on the problem definitions, products, materials used, and representation techniques of the exercises.

Epistemological Differences in Design Education

Design thinking is generally considered as the ability to combine empathy, creativity, and rationality to analyse and fit solutions to contexts, and more recently, it has been closely related to innovation (Wrigley and Straker, 2015: 375). Hence, one can argue that design stands at the point of multi-disciplinary approaches and epistemological discussions.

Artistic and Intuitive vs. Rationalistic and Analytic

The two oppositional epistemologies, namely "technical rationality" and "pragmatism or phenomenology" (Ghajargar and Bardzell, 2019) can be applied in design education. Roughly speaking, architecture and design education had been under the influence of Fine Arts in many countries (Tekeli, 2001; Yürekli, 2021) until the birth of Bauhaus. In this art-based view, the subjectivity of intuition had been welcomed and considered the sole way to design (Orbey and Sarıoğlu Erdoğdu, 2021). Certain skills such as learning materials by giving them form, learning geometry, colour, space, and structure through drawing, painting, and model making, were used to gain information from the Beaux-Art perspective (Pasin, 2017).

For some, the first group of scholars and designers follow anti-methodological approaches (Jormakka, 2014). Aalto can be a good example where Jormakka views his designs as "play", rather than employing scientific methods (Jormakka, 2014). The followers of this understanding were characterised by "accidentalism" in their design perspectives (Jormakka, 2014). Similar methods were also applied in the 20th century by the surrealists, who adopted a parlour game, "Exquisite Corpse". In this "game", rather than an individual, a group of designers works together. The first designer draws something on paper and then folds the paper so that the second designer does not see what has been drawn. Without knowing what is on the paper, the second designer continues the design. In the end when the paper is unfolded "the whole" can be seen. This method was argued to be a perverse assembly-line and mechanisation in the industry (Foster, 1991). Especially for developing the form of the buildings, such irrational and random techniques of surrealism were utilised by some architects like Wolf Prix and Helmut Swiczinsky (Jormakka, 2014).

The collage principle was argued to be the fundamental structure of the 20th century in aesthetics, social, scientific, and philosophical thought (Adamowicz, 1998). Through collage and accidentalism, new concepts of space were added to non-Euclidean geometry (Adamowicz, 1998). Hence, the dialectic between the rectangle and the free form, between the grid and the kidney shape, was of great significance (Sorkin, 1991).

At the Bauhaus, an opposite approach was developed which focused on rational thought and objectivity (Jormakka, 2014). Beginning as a spontaneous attempt, an open-ended and experimental mode of designing was introduced (Yeomans, 1992:72). Meyer, the director at the Bauhaus in the 1920s, argued that as architecture is not one of the fine arts, then subjective intuition has no place in the architectural design process (Jormakka, 2014). Following this argument, architecture as an observable, measurable, and scientific activity finds its place in the modern world such that students are enrolled in architecture schools according to their mathematical backgrounds and analytical knowledge.

A similar categorisation was made in the display of basic design at Tate Britain in 2013, regarding Basic Design Teaching: Rational Process, Science and Nature, and Intuition (Crippa and Williamson, 2013). However, Bauhaus became so globally dominant, established, and prescriptive in time that this dominant position was against to its unique and utopian character (Boellen, Botha and Sacchetti, 2018). They argue that Bauhaus was once a pioneer and differentiating approach, and yet its current dominance is all but contrary to its initial perspectives (Boellen, Botha and Sacchetti, 2018).

Another component to this duality, technology is added (Findeli, 2001), as he finds the adoption of the two design paradigms, namely applied art, and applied science, outdated. Since the beginning of the 2000s, digital technologies have been occupying design studios while bringing their own unique logical thinking ways and changing methodologies as it is denoted although, in basic design courses paper-based design thinking and analogue tools are dominant (Oxman, 2008). In this sense, design education is argued to need a wider restructuring regarding the information age, towards complexity (Uysal and Topaloğlu, 2017). As it is denoted that studio cultures aim for collaborative and participatory skills in individual creativity with computational methods since the reasoning processes of design and new opportunities arise for open and liable cultures of design (Hysa and Özkar, 2020: 343).

However, shape grammars and parametric design methods which were developed since the 1960s could not promise much though, as the computer cannot replace the designer totally (Goldschmidt, 1988). The use of computational precedents is counterproductive with respect to design creativity (Goldschmidt, 1998), and without sorting or evaluating possibility the generative program is of little value (Jormakka, 2014).

In sum, perspectives on design thinking have evolved from an artistic point of view to firstly a rationalistic and scientific approach at Bauhaus, and then finally to a complexity sciences approach where technology plays the

primary role (Orbey and Sarıoğlu Erdoğdu, 2021, Mennan, 2008). This has not been an "all black" and "all white" type of distinction, though. All design perspectives have both artistic and scientific components in different weights and their relative significance has gained different positions throughout the ages and places.

Differences in the Level of Abstraction in Basic Design Education (Abstract-Conceptual vs. Concrete-Environmental)

The second difference in basic design education stems from the level of abstraction in the course. In some universities Euclidean space and abstract conceptualisations dominate the basic design course while in some other ones, environment (place) and concrete perspectives are utilised (Sarıoğlu Erdoğdu, 2016). When studying in Euclidean space, the relations with the characteristics of the place/ site and/or environment are not included in the design process as a primary concern. This also aligns with the fact that first-year students are not yet accustomed to building science, construction technology, and site analysis. As such, an abstract basic design course provides students with skills to manage the design process rather than focusing on the details of a site (like geographical and climatic data; demographic features of the population, financial issues related to construction, construction materials, and methods, etc.) as novice designers are not aware of what and how they act while designing yet (Gürer, Özkar and Çağdaş, 2014). Correspondingly, basic design studio remains abstract both in problem definition and products and deals with abstract tasks that are segregated from real-life architectural issues (Gürsoy and Özkar, 2015).

Also, representation techniques and the materials used in the studio may differ. In abstract basic design courses, more process-oriented and relatively conceptual designs are produced whereas the concrete-based basic design courses might engage mostly with finished and detailed projects. You may come across freehand sketches and conceptual diagrams quite often in abstract basic design courses whereas scaled and more detailed drawings may be more often employed in site-specific and concrete basic design courses.

On this basis, the basic design course can be considered in a matrix of five categories: artistic/scientific/technological aspects (epistemological position) and abstract/concrete position (level of abstraction). Such a framework is suggested in this paper to provide a better explanation of understanding basic design education.

BASIC DESIGN COURSE AT DOĞUŞ UNIVERSITY AND EXQUISITE CORPSE (EC) FINAL PROJECT

Although first-year design education recalls the basic design of Bauhaus, not all follow the basic design perspective. Further, not all of them are studio-type courses, sometimes basic design is a supporting course given separately but assumed to be in parallel with the studio as in the case of Doğuş University. Here, in the Department of Architecture, design is viewed more as a scientific activity that requires analytical thinking following the Bauhaus approach and the basic design perspective. Hence, the basic design course, as one of the pioneering courses for freshmen students, is formulated to provide an environment where abstract and conceptual designs are made which depend mostly on the Gestalt principles and Bauhaus methods. Mostly, students were allowed to use only basic geometric forms in many of the exercises and free forms were not permitted. However, to increase students' abilities to design with free forms, EC was then employed as a thematic/ umbrella term in the basic design course. Such a diversion in the curriculum also aimed to increase the conversation skills and capacities of students within group work. Both of the approaches depend on learning by doing, yet EC is a group work so the game understanding is dominant.

The 3 relief designs at the upper row are includes designs developed by two students according to EC. The lower row of Figure 1 demonstrates student works from previous terms where relief models are mostly with basic geometric forms. Determining triangles/squares as the basic unit works in the second row are more harmonious and unified and hence can easily be described with Gestalt/Bauhaus terms like harmony and unity. Also, as the designer is solo in the whole process, the so-called eclecticism problem of EC is not an issue in the lower row works. On the contrary, in the first row, works represent two clearly differentiable design perspectives of the students designing in an EC game and seem to have a more complex structure.

Even though the basic design course is an abstract course at Doğuş University, where standard geometries are prioritised, the final project is developed to include EC, an opposite design perspective that recalls more artistic components. This was possible as for the final project, the development of a more complex formal language was a priority rather than incorporating functional, geographical-environmental, and economic concerns of architecture. Also, the rationality of the Bauhaus Ecole does not contradict the collaboration brought by EC. As declared by Mostafavi (2019), the Bauhaus seeks out collaborative pedagogy and tries to incorporate conversation into the process of knowledge creation.

As EC requires at least 2 persons at play further enabled and required to develop dialogue between the group members. The aim of incorporating "Exquisite Corpse" into the curriculum was to encourage students to explore alternative forms that allow them to produce complex design solutions and non-standard geometries. It is suggested that first-year students display discouragement in discussing their

Figure 1. Student works in basic design course at Doğuş University.

works and design processes (Özkar, 2011). The inclusion of EC, by definition, required group work at all phases of the design and hence enabled discussion among students about their designs. Furthermore, a curriculum based on an art stemmed approach, EC promised qualitative and quantitative increases regarding formal explorations. This process of form development is mostly known as formal explorations in the literature and as such, students deal with diversified solutions in the search for better fits to the given design problems with the help of EC. Group work and the "game" understanding behind the Exquisite Corpse approach facilitate the form development process of novice designers is facilitated.

In addition to EC, Decision Trees (DT) were developed by students as a compulsory submission in the final project. 4 clusters of concepts were given to students for the Decision-Making Process where they picked one from each cluster. Students needed to develop their own methods to utilise the benefits of both EC and DT in their design processes.

Final project: Exquisite Corpse Architecture: Abstraction, Geometry and Morphology

For their final project which was titled "*Exquisite Corpse Architecture: Abstraction, Geometry, and Morphology*", students worked as a group of two and were first asked to create a "decision tree" by selecting one item from each cluster listed below (Table 1) and then design compositions

Table 1. Clusters given to students for the decision-making process

1st Cluster Gestalt Principles	2nd Cluster Concepts	3rd Cluster Form	4th Cluster Spatial Properties
- **Continuation**	- **In between**	- **Orthogonal**	- **Boundary elements:** *such as a wall, column, and beam*
- **Solid-void**	- **Transformation**	- **Diagonal**	- **Orientation and way finding elements:** *such as corridor,*
- **Visual Balance**	- **Transition**	- **Curvilinear**	*point, and continuity elements*
- **Hierarchy**	- **Still/stable**	*(Basic geometric forms and*	- **Focal points:** *such as entrances and nodes, which are distin guished from composition*
- **Order**		*free forms can be chosen)*	
- **Repetition**			

to convey the expression of concepts of an abstract morphology model according to the decision tree that they created as a group in the first phase. The first cluster was based on Gestalt psychology, which involves the mind's simplification of the environment during the act of perceiving. The second cluster was based on the concept of visual inertia which reflects the degree of concentration and stability of a form that is related to the third cluster, form, and geometry. The last cluster, spatial properties, was based on the elements that help define a space in architecture.

The process, which is summarised in Figure 2, required both solo and group works where two design perspectives are combined into the final model.

In steps 1 and 2 (Figure 2), students are solo whereas in step 3 they start working together. Integration and collaborative gaming that EC requires to start in step 3.

The Participants and the Procedure

A total number of 73 students took part in the study. The study group consisted of 39% female and 61% male students. All students were from the Department of Architecture in the Faculty of Fine Arts and Design at Doğuş University. Students received course credit for their participation.

1st Week: Research, decision tree, and poster design: The instructions for each task were explained to the participants in the first week by the same two instructors. Verbal definitions of the concepts were also described briefly before starting the design phase, but the instructors did not show any visual displays. The students were first to do research on the concept of *"Exquisite Corpse Architecture"* and prepare a poster that includes both verbal and visual information including their research on the concepts of EC, morphology, and topography. In this poster, they were also asked to prepare three alternative decision trees, three design rules (algorithm), and three 2D abstract designs (30 × 30 cm) accordingly. The compositions were told to be designed as plan views through black and white compositions and only red colour were allowed for expressions. Vertical posters (50 × 70 cm) were asked to be prepared to complete this phase of the study (Figure 3: only visual parts are shown in the image, title blocks are cropped).

2nd Week: Physical modelling: Design alternatives of each group from the previous week were discussed based on the course curriculum for their originality and creativity and were dropped to one design alternative. It was expected that the task of thinking about the decision tree and combining one item from each cluster involved bringing out the harmony and/or distinctiveness of each concept in relation to the other and reaching *unity* in their overall design. Based on the chosen 2D design alternative, 3D abstraction and physical model production on a 30 × 30 cm work area with no height limit were asked to be done as a group. Students were told to use 2 mm white photo blocks, transparent materials, and red-coloured materials for model production.

Group Design vs. Solo Design

The students were first asked to think about the design concept as a group but then also asked to work individually by taking turns during the design phase as the concept

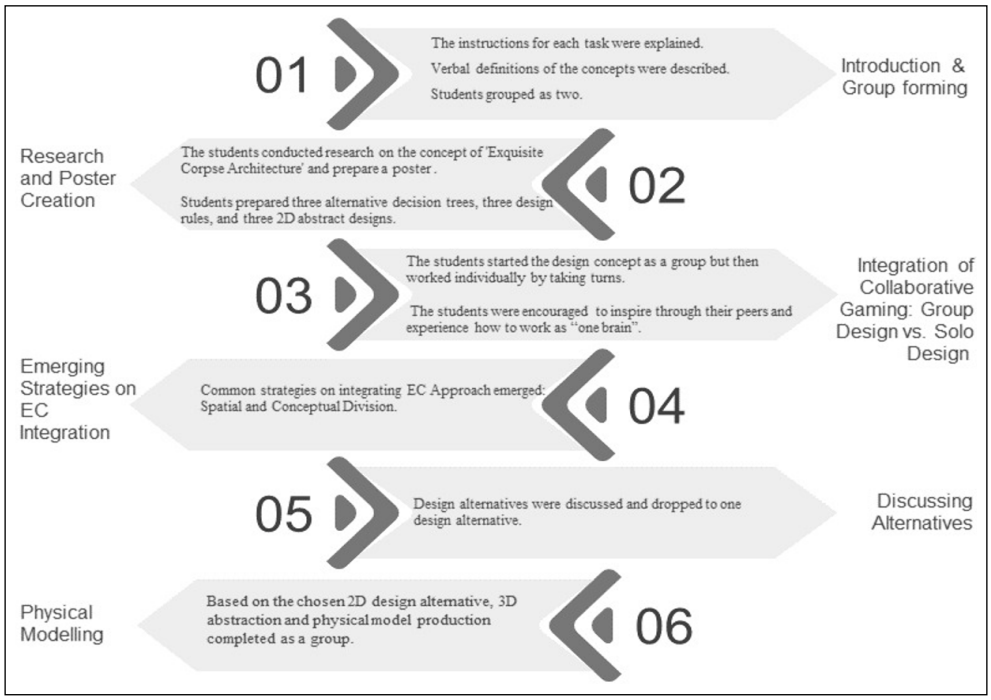

Figure 2. Design process: From solo to group work.

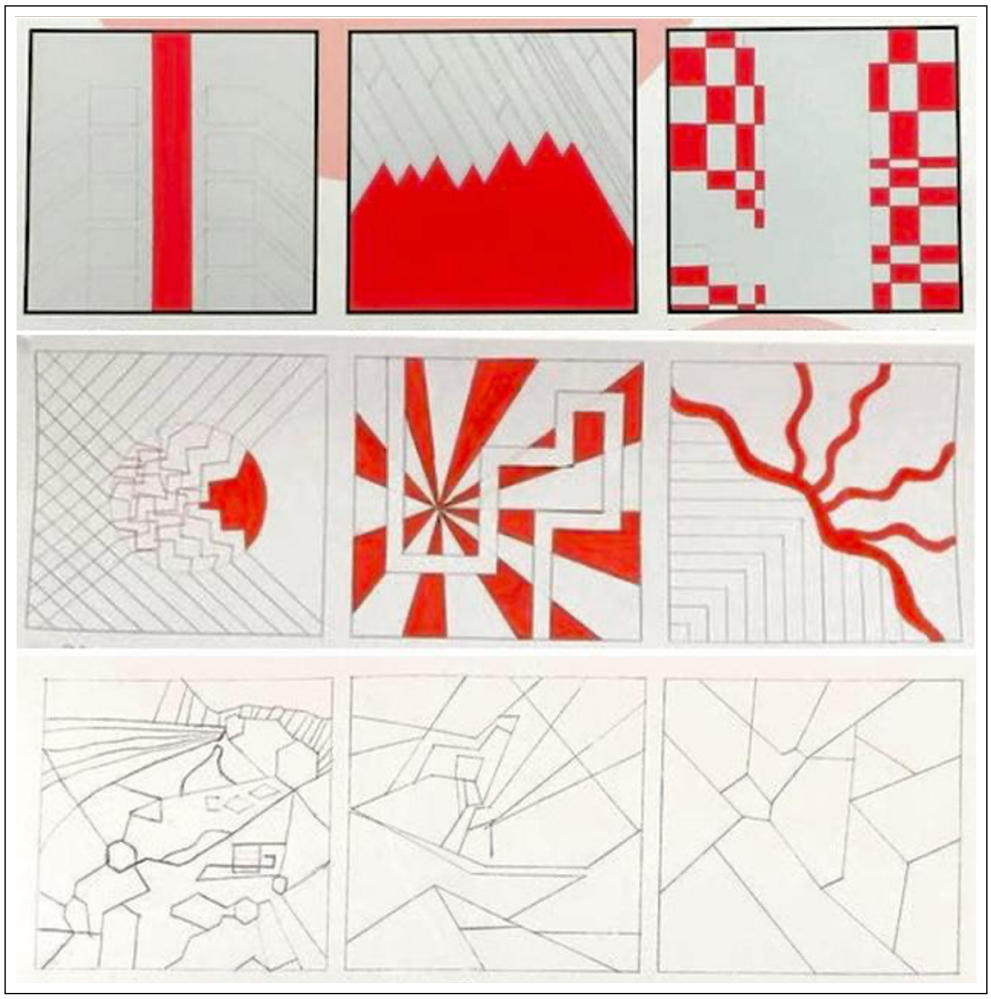

Figure 3. Exemplary student works: Posters.

of EC Architecture is based on the idea of *collaborative gaming*. Therefore, students were asked to come up with their own game rules in terms of how they "*collaborate*" within their design process. The expectation behind this process was to expose students to the opportunity in which they could achieve fresh inspiration through their peers and experience how to work as "one brain".

Eventually, in terms of the collaboration type among the groups, two main strategies emerged. The first common strategy used by groups was that each participant drew on a folded page, concealing each turn from the next until a cumulative design was formed. The second common strategy that emerged among the students was based on the idea that the participants divided the clusters among themselves and worked on the same page individually by taking turns (without folding or concealing) yet only using the clusters that they selected. Regardless of the strategy type, students were expected to examine and question the conventions of authorship, coherency, predictability, individualism, and composition inspired by the concept of Surrealists' cadaver exquisite.

Another result of incorporating EC in the design process stems from its artistic grounds as the course is given in an architecture department. In the first-year design studio, this has not been perceived as a problem but as a valuable input that could increase the creativity and abstract thinking of the students. As the design problems of the studio did not involve functional aspects, both creativity and abstract thinking brought by EC were welcomed.

Obviously, the final project based on EC ended up with the anticipated visual results: two clearly differentiable design attitudes which barely form a unity in the final product (Figure 4). The joint sections especially emphasised the inclusion of EC in the design problem, which can be referred to as eclecticism. A similar issue was raised in a study of EC where the authors argued that an emergent criterion for the evaluation of Exquisite Corpse images, is compositional unity and that the final product can be read like the work of four individual artists, each with their own technique and idiosyncrasies (Weir et al., 2018).

This was however also the expected benefit of incorporating EC in the final project. As the Exquisite Corpse is argued to

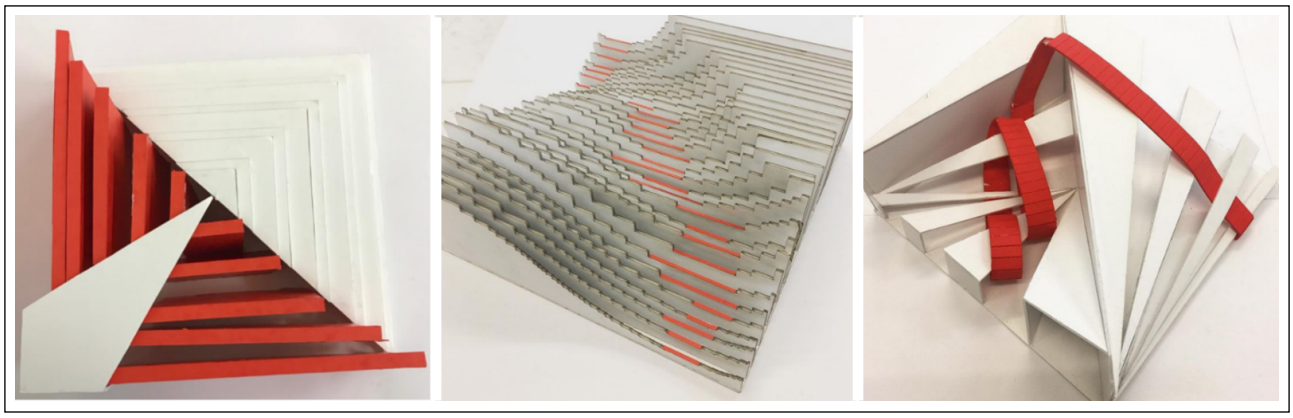

Figure 4. Exemplary student works: Models.

lead to "disturbing" and "arbitrary" designs (Dali, 1932) where the end-product frequently has remarkably beautiful details notable for their distinct juxtapositions (Weir et al., 2018).

METHODOLOGY

Method

Architecture's multi-disciplinary structure affects not only its theoretical foundations but also its methodological approaches. Although it is stated that the main qualitative data types employed in architecture studies are texts, pictures, maps, and drawings, there are studies that employ quantitative methods even when artistic and more subjective elements are the focus. (Habib, Etessam, Ghoddusifar, Mohajeri, 2021). For instance, in a study, an analytical tool to quantitatively evaluate qualitative features such as aesthetic value of facades is employed (Meddahi and Boussora, 2021). In another study, both qualitative and quantitative methods are utilised to enhance the understanding of the design process in architecture, which is a subjective aspect (Orbey and Sarıoğlu Erdoğdu, 2021). Numerous studies reviewed the changing methodological perspectives and highlighted the need for mixed approaches that combine distinct research methods for better understanding (Berta, Bottero, and Ferretti, 2016; Cieslikowska, 2020; Orbey and Sarıoğlu Erdoğdu, 2021; Pietrzyk, 2022).

In this study, in order to summarise the data in an understandable and meaningful way, descriptive statistics were employed through quantitative descriptions of the sample (Sommer & Sommer, 2002). Particularly, descriptive statistics were useful to describe the characteristics and patterns of the subjects. Contingency tables (or frequency tables) were used to tabulate categorical data. The unit of analysis used for the study is students. All statistical analyses were conducted with the SPSS software program with a priori level of significance of 0.05.

In the literature, there are challenges in determining definitive approaches to design research due to various factors. According to Maxwell (2010), distinguished qualitative researchers such as Howard Becker and Martyn Hammersley have advocated for the incorporation of "quasi-statistics" to enhance the accuracy of statements using terms like "some," "usually," and "most." These counts offer precise information on how frequent, typical, or substantial particular occurrences are. However, it is also acknowledged that this precision comes at the expense of excluding non-quantitative details. Therefore, numerical data should complement qualitative information rather than replace it. This study identifies several significant reasons for utilising numerical analysis, including:

- Quantitative data can reveal patterns that are not immediately obvious from the qualitative data alone.
- It enhances the internal generalisability of qualitative research findings. This refers to the ability to generalise the themes or findings identified within the specific setting or group studied, establishing that they are representative of the entire population studied. This is particularly important for case studies, as the validity of the conclusions depends on their internal generalisability to the participants or the case as a whole.
- Quantitative data allows for the identification and accurately describing the diversity of actions, perceptions, or beliefs in the setting or group being studied.
- Individuals often have limited knowledge of broader patterns beyond their immediate experiences, and quantitative data can complement their perspectives by providing a more comprehensive understanding of what is happening in a particular setting or for individuals belonging to a specific category.

Also, quantitative data serve as valuable evidence to support interpretations and helps in evaluating the amount of evidence in the data that supports a specific conclusion (Becker 1970; 1990).

Therefore, in this study, the discussions on research methods

as such are evolving and an alternative basic design course curriculum is first presented and secondly its effects are analysed by carrying out a quantitative method (descriptive studies (frequency charts and cross-tables) and correlational investigation (chi-square tests)). Grades of the students (A+-F) are used as a categorical variable and are included in the analysis in this context to measure the success of the students. Rubric matrixes were employed to guarantee fair grading across instructors, where models and posters were equally important in terms of their "consistency", "on-time submission" and "design quality".

Data and Research Questions

At the end of the semester, an online questionnaire was distributed to students. After missing cases were omitted, the raw data consisted of 73 cases. The aim was to enhance our understanding of the design processes of novice designers and more specifically, the use of EC as a guiding instrument in a design problem, and its effect on students' grades. Secondly, the use of decision trees (DT) in design processes was investigated as a part of design processes. As such, primary research questions were formulated as follows:

1. How did the students' employment of EC in their design process (i.e., either by "*areal-spatial division of labour*" or by "*conceptual division of labour*") affect their success?
2. How did the students' employment of "decision tree" in their design process (i.e., "*first design then decision tree*" or "*first decision tree then design*") affect their success?

RESULTS AND EVALUATION

Descriptives

EC

Two primary ways have been used by the students to employ EC in their work. They either selected certain parts of the models (denoted as "*areal-spatial division of labour*" in the Tables and Figures) or alternatively, they picked from their selection of "concept cluster" (denoted as "*conceptual division of labour*" in the Tables and Figures) and designed according to these concepts individually.

Regarding the first research question on how EC has been incorporated into the final designs, *spatial division of labour* has been the far most preferred approach among students by 70%. In other words, 70% of all students shared certain parts of the model and carried out their designs separately in those pre-determined specific areas (Figure 5).

Apart from being the most frequent choice, this approach in the end led to slightly higher grades on average (75 compared to 72 over 100). Almost 25% of all students in this group (spatial division of labour) received A or A+ while the very same ratio for the other group (conceptual division of labour) is 20% (Table 2).

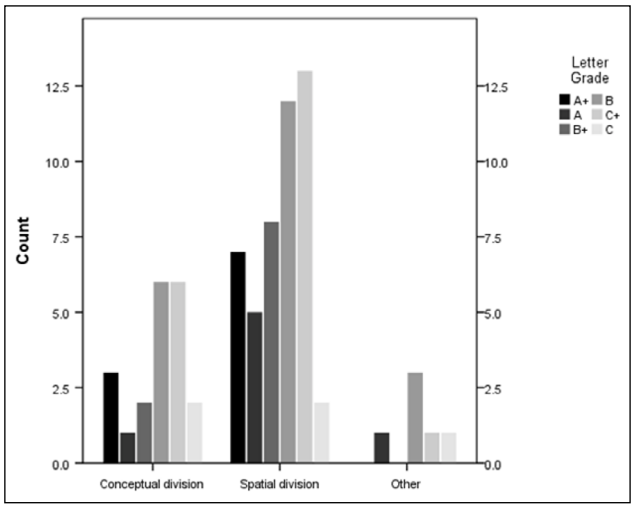

Figure 5. Frequency distribution of EC approach (count) and grades.

Accordingly, one can argue that depending on the grade differences between the two groups, the spatial division of labour could have been facilitating/orienting the design process better than the conceptual division of labour only slightly. This approach, namely sharing the workload over the physical model, could be more practical in group work where individual creativity could have been utilised the most. Also, spatial division of labour might be, by definition, a more suitable way of adopting an EC approach in design.

Only 6 students stated that they employed another approach to employ EC in their design and represented in Figure 1 and Table 1 as "other". Although low in score, they have explanatory power. One student said:

"*One by one, we added individual forms to the design*",

Revealing that they preferred to use their beforehand designed modules/units as a basis, or they developed new formal explorations at each step. In any case, they had worked inductively on a formal axis. This is in fact another way of the spatial division of labour where the designers felt comfortable working incrementally and mostly on smaller parts of the model.

Another student denoted that

"*During the design process, we changed our way of EC employment more than once*".

Meaning that they employed EC in different ways at different times in their design which emphasises the dynamic and cyclic nature of the design process where EC is used as a leverage point.

In summary, EC has been employed in a variety of ways in design processes, and those who made spatial labour of division in model-making received barely higher grades.

Table 2. Cross-tabulation between EC approach and letter grades

	EC Approach and Letter Grade Cross-tabulation						
	Letter Grade						Total
	A+	A	B+	B	C+	C	
EC Approach							
Conceptual division							
Count	3	1	2	6	6	2	20
% Within EC Approach	15.0	5.0	10.0	30.0	30.0	10.0	100
% Within Letter Grade	30.0	14.3	20.0	28.6	30.0	40.0	27.4
% of Total	4.1	1.4	2.7	8.2	8.2	2.7	27.4
Spatial division							
Count	7	5	8	12	13	2	47
% Within EC Approach	14.9	10.6	17.0	25.5	27.7	4.3	100
% Within Letter Grade	70.0	71.4	80.0	57.1	65.0	40.0	64.4
% of Total	9.6	6.8	11.0	16.4	17.8	2.7	64.4
Other							
Count	0	1	0	3	1	1	6
% Within EC Approach	.0%	16.7%	.0%	50.0%	16.7%	16.7%	100.0%
% Within Letter Grade	.0%	14.3%	.0%	14.3%	5.0%	20.0%	8.2%
% of Total	.0%	1.4%	.0%	4.1%	1.4%	1.4%	8.2%
Total							
Count	10	7	10	21	20	5	73
% Within EC Approach	13.7	9.6	13.7	28.8	27.4	6.8	100
% Within Letter Grade	100	100	100	100	100	100	100
% of Total	13.7	9.6	13.7	28.8	27.4	6.8	100

Decision tree

The second research question was on the decision tree that students had to develop in the design process. About 75.3% of all students developed their decision trees *before* they started designing which aligns with the aims of planning tree in the first place (Table 3). "Decision tree" was meant to be a facilitator for novice designers in their first final design projects and hence was a part of the final submission list.

And yet, as Figure 6 visually indicates, those students who developed their decision trees in advance received lower grades. Of the whole A+ and A grade receivers, almost 60% stated that they developed their decision trees *after* their design was completed.

This supports that decision trees was not used as facilitators by the students, contrary to the initial aim. Rather, they were developed mostly because it was a compulsory item in the submission list. Grades of the students revealed an opposite trend: when decision trees are prepared after the design is completed, they received higher grades on average (83 vs. 71 over 100).

Chi-Square Analysis

In addition to the descriptive analysis, in this paper, a chi-square analysis was further carried out between the grades of the students and their EC incorporation and decision tree approach. To answer relational questions, correlational analysis was used as a tool in this study. Since the research questions of the study aimed to examine associations between variables rather than predicting the outcome variables, Chi-square tests were the preferred method. To investigate correlations with non-continuous and/or frequency/categorical data, relationships between variables can be found that contain frequency data using a test called the chi-square test (χ^2) for independence (Wan, He and Tu, 2012).

Since the independent variables of the study (students' decision-making process: use of decision tree (use of decision trees before or after) + choices on clusters of the decision tree, and use of exquisite corpse method (spatial or labour division)) were nominal categorical, Pearson's Chi-square test was used to test for independence between the nominal and ordinal categorical variables of the study.

Table 3. Cross-tabulation between "Decision Tree" and "Grades"

	Cross-tabulation						
	Grades						Total
	A+	A	B+	B	C+	C	
Decision-making Process							
First design then decision tree							
Count	8	3	1	2	3	1	18
	44.4	16.7	5.6	11.1	16.7	5.6	100.0
% Within Grades	80.0	42.9	10.0	9.5	15.0	20.0	24.7
% of Total	11.0	4.1	1.4	2.7	4.1	1.4	24.7
First decision tree then design							
Count	2	4	9	19	17	4	55
	3.6%	7.3%	16.4%	34.5%	30.9%	7.3%	100.0%
% Within Grades	20.0%	57.1%	90.0%	90.5%	85.0%	80.0%	75.3%
% of Total	2.7	5.5	12.3	26.0	23.3	5.5	75.3
Total							
Count	10	7	10	21	20	5	73
	13.7	9.6	13.7	28.8	27.4	6.8	100.0
% Within Grades	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% of Total	13.7	9.6	13.7	28.8	27.4	6.8	100.0

When more than 20% of cells had values lower than 5, the Likelihood Chi-square test was used as an alternative to Pearson's chi-square test as it does not require to have values of more than 5 in each cell (Agresti, 1996). Besides looking at the chi-square significance value, the strength of association was also calculated when there was significant evidence found of a relationship between the variables. In terms of measuring the strength of associations between the independent and dependent variables, Cramer's V, as a measure of strength, was calculated to measure the strength of the association between one nominal variable either with another nominal variable or with an ordinal variable reported. When calculating Cramer's V, both variables can have more than two categories. It applies to either nominal × nominal crosstabs, or ordinal × nominal crosstabs, with no restriction on the number of categories (Agresti, 1996). On the other hand, to measure the strength of association between ordinal categorical variables (i.e., to examine the interactions between the individual-level variables of the study), gamma, as a measure of association for ordinal variables, was calculated and reported. The gamma ranges from -1.00 to 1.00. A gamma of 0.00 reflects no association with a gamma of 1.00 reflects a positive perfect relationship between variables. A gamma of -1.00 reflects a negative perfect relationship between those variables (Agresti, 1984).

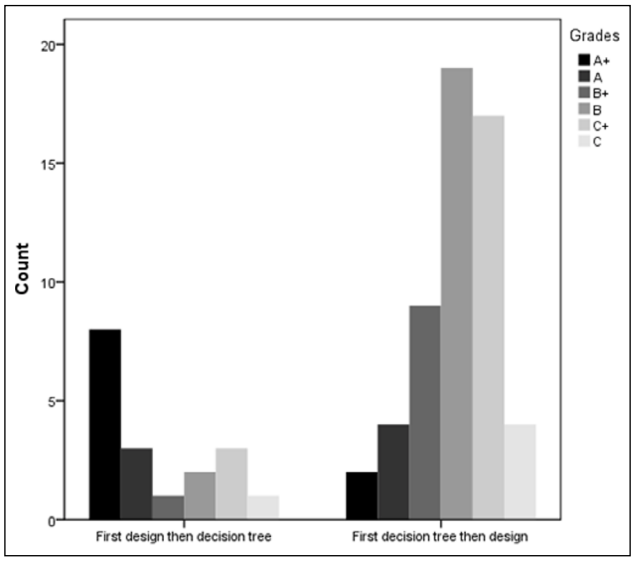

Figure 6. Decision-making process in relation to grades.

Use of EC Approach (Spatial vs. Conceptual Division) and Grades

A Pearson's chi-square test of independence was performed to examine the relation between students' use of the exquisite corpse approach (spatial × conceptual division) and their grades. There is no significant evidence found of a relationship between these two variables, Pearson χ^2 (2, N=73) = 0.410, p=0.815.

As the grades of the students did not vary significantly depending on the EC approaches (Figure 5), chi-square analysis did not find a significant relationship.

Decision-Making Process (Use of Decision Tree) and Grades

A likelihood chi-square test of independence was performed to examine the relation between students' use of decision trees and their grades. The tests between these two variables were found to be statistically significant at the 0.05 significance level for the following:

χ^2 (5, N=73) = 20.35, p = 0.001, with a moderate (Cramer's = 0.55) effect size.

Hence, use of decision trees before or after was found to be significantly affecting the grades of the students which was already pointed out in Figure 5.

Evaluation

The descriptives and chi-square analysis carried out for EC and DT were an attempt to enhance our understanding of the design process of novice designers. Incorporating both EC and DT in the final project aimed to help freshman students guide their design processes. Yet, the results demonstrated a different perspective.

Employment of EC in the design process, apart from its formal and creative capacity, proved to serve as a facilitator only when a spatial/areal division of labour was made. The results allow the conclusion that the incrementalist nature in EC (that designers must work one by one) is more suitable for the physical separation of the product (in our case the model). Attempting to separate the conceptual thinking and assigning different ideas/concepts to different designers -which can perhaps be accepted as the philosophical background of the design- ended up in less successful designs in terms of grades received.

Analysis on employment of decision trees revealed that developing the decision tree in advance received lower grades on average. This might suggest that obeying a set of predetermined decisions in a design process is hard to carry on for novice designers. In such cases, rather than facilitating, decision trees turned out to be limiting the design capacity of the students and their problem-solving skills. On the contrary, developing decision trees afterward meant to be just the preparation of a graph of which the details had already been decided. Also, not spending time developing a decision tree in advance, this group of students started designing before and hence found more time on solving design problems faced during the process.

This finding is broadly consistent with the previous works in the design literature suggesting its cyclic nature where designers must go back and forth to make necessary changes in a design process (Schön, 1983; Sarıoğlu Erdoğdu and Orbey, 2017) and by rule, design cannot begin with a preconceived idea (Rand, 1946). Hence, "decision trees" as a guiding instrument, prevented such movements of novice designers adversely either because of time constraints created or their inability to modify pre-given decisions of themselves. From the other side of the token, this finding suggests that the use of DT in a design process does not guarantee successful process management.

CONCLUDING REMARKS

Many perspectives in design education require scientific methods for enhancing it. The analysis used in this paper provides scholarly information to other design educators in higher education. The initial aim is to incorporate EC and DT in the final project were to help novice designers in guiding their design processes better. As a more heuristic approach, EC was more effectively used by the students. The findings suggest that Exquisite Corpse is a powerful method for novice design students to learn and implement in their design processes even in abstract types of basic design studios. However, the use of a more rationalistic way, namely DTs, in the design process did not yield successful results in terms of grades.

EC was used in a variety of ways by the students, two major paths being spatial division of labour (1) and conceptual division of labour (2). When the grades of the students are compared as an indicator of successful design, EC is proved to be an alternative way of facilitating/orienting the design process if the former path has been chosen by the students, namely the spatial division of labour. If EC is utilised by students for a separation in the conceptual level (a conceptual division of labour), however, the grades were significantly lower. In terms of DT, using it as a guiding instrument in the design process was not found to be an effective approach. Rather it can be argued that it adversely limits the design movements of students especially when prepared in advance.

The paper highlights the need for distinct methods for the scientific analysis of design research. In this context, a path is introduced based on a quantitative analysis of design-based research questions. However, like every study, this study has some delimitations. Other than "grade of the students" as the dependent variable, there were no further statistical analysis options in the available data set. Also, how to combine qualitative and quantitative methods will be still on the agenda as there is a need for developing innovative ways for analysis for multi-disciplinary research areas of design, architecture, and urban design. Our model is an attempt to exemplify analytic research for design-related branches that may be accepted to be another future research of the paper.

[1]*Rotterdam Academie van Bouwkunst (RAvB) https://landscapearchitecturetudelft.nl/cadavre-exquis-20/ Accessed 13.06.2020; Robotics Research and Advanced Manufacturing*

research group at the Sydney School of Architecture, Design & Planning and Gosford Quarries (https://sydneydesign.com.au/2019/event/exquisite-corpse-catenary-vaults/) Accessed 15.07.2020; A symposium held by The Berlage Center for Advanced Studies in Architecture and Urban Design entitled "Exquisite Corpse: Architecture Assembled". http://www.theberlage.nl/events/details/2016_06_03_exquisite_corpse_architecture_assembled Accessed 15.07.2022; a master's thesis entitled "Exquisite Corpses: an architectural mystery" at Massachusetts Institute of Technology. Department of Architecture by Canizares, Galo http://hdl.handle.net/1721.1/89939 Accessed 10.03.2022.

[2]At Yıldız Technical University, in the Department of Architecture as a separate course and, at Middle East Technical University, in the Department of Architecture as an individual studio course, for instance.

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