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Search for a new metafunctional education pattern in basic design studios after the COVID-19 pandemic

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Abstract

After the COVID-19 pandemic, basic design studios given in the first year of architectural education in Turkey have undergone a new accelerating process based on using physical design techniques with digitalization. The current study proposes a new curriculum that integrates the ideational, interpersonal, and (con)textual metafunctions of language into basic design learning to facilitate the integration of physical and digital tools. It was applied in the first semester of the basic design curriculum through face-to-face education. At the end of the term, we surveyed first-year students to learn about the positive and negative aspects of making designs in physical and digital environments. The results demonstrated that they are undecided and have some hesitations in representing their design ideas physically, while they are relatively confident of the advantages of designing in the digital environment. However, although 3D representation has become easier with the use of digital tools and students' digital representation skills have improved, it has also been observed that students' perceptions and understanding of 3D and spatiality have not improved at the same rate.

Keywords

Basic design education, Digital representation tools, Language metafunctions, Physical representation tools, Post-pandemic design curricula.

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1. Introduction

Architectural education in Turkey has been established on a two-partite ground of a design-learning approach, which consists of basic design teaching for first-year students and architectural teaching for consecutive years in a four-year education period. Basic design education covers the learning of the fundamental principles of making design in general respect; therefore, the Bauhaus education system may also be followed to teach the methods and principles of abstraction, Gestalt and composition principles, design themes, and elements during the first year—and especially in the first semester. In this respect, first-year education mainly comprises a curriculum that teaches students to reflect upon a design idea and derive concepts by producing in the physical environment. However, expressing a design idea with different representation techniques—including digital ones—communicating interpersonally using these techniques, and the effects of these techniques on students are not generally undertaken among the main aims of basic design studios.

In architectural education, on the other hand, students are introduced to the realistic and concrete design phase of the curriculum and start to produce within a tangible and realistic design language. They jump into a new world whose rules are composed of the multi-dimensional problems and solutions of architectural design, such as the choices of materials, structures, and spatial programs with complicated functional approaches. The concept derivation phase may be kept shorter in time, and the phase covering the project's development in realistic details with different representation techniques—especially digital ones—is favored and spans longer. Therefore, after a one-year education focusing on learning concept derivation and its representation with physical techniques, students generally have difficulty adapting themselves to digital representation techniques used for both concept derivation and project development phases and interpersonal communication. Hence, the education system of architecture in Turkey generally has a break between the first year and the consecutive ones in terms of the design of the curricula and the balance between conceptual reflection and interpersonal expression. In this respect, providing a smooth transition from the first year to the upper years has always been among the essential issues of the education system.

To facilitate the smooth transition from basic design to architectural studios in architectural education and to strengthen the ties between them, a joint conceptual and verbal competence structure can be established in the curricula. At this point, if it is considered that design corresponds to a language, it would be helpful to examine the grammatical models of linguists. A critical system that has previously been integrated into the curriculum of design studios is Michael Halliday's (2004) theory of Systemic Functional Linguistics (SFL). This system describes three basic metafunctions (Halliday, 2004): ideational, interpersonal, and textual. While the ideational phase defines a passive and reflexive level where the individuals search for and reflect on their thoughts through language, the interpersonal phase represents an active level based on the exchange of ideas and active communication through which individuals express their thoughts. On the other hand, the textual plane corresponds to the grammatical parts and the whole and their relationships through the structural elements of the language to make meaning (Halliday, 2004). Although this system has been widely undertaken comparatively and analytically in the cognitive processes of design thinking and representation, it has not yet been approached based on a basic design studio curriculum.

On the other hand, basic design education in architecture schools has a structure that forms the core of the design education system. Architectural education has always needed transformation and adaptation to the emerging dynamics of contemporary tendencies since integrating the Bauhaus approach in basic design courses (Norberg-Schulz, 1988). However, as Christian Norberg-Schulz (1988) also stated, to address the complexity of

architectural problems, the education system should renew itself in terms of contemporary issues and tendencies. In this respect, the trials to renew the education system and open new ways of comprehending and representing design should be increased to integrate basic design curricula to the changing necessities of the time.

Therefore, basic design education with curricula primarily based on the Bauhaus school tries to survive in the age of information technologies. Hence, the adaptation tendencies have already started before the COVID-19 pandemic (Özkar, 2017). The discussions of the use of digital tools in basic design education have been accelerated by the changing needs for time management and augmented expression possibilities provided by these tools in the new age (Caldwell & Woodward, 2012; Özen Yavuz & Yıldırım, 2012a; Uysal & Topaloğlu, 2017; Özgen et al., 2021). However, especially when we examine the basic design education in the architecture departments of Turkey, we may see that the effects of the Bauhaus understanding can still be felt in the current curricula, even though the main approaches are tried to be integrated into the new digital technologies.

During the COVID-19 pandemic, because education was held online, the use of new technologies in design representation appeared as a necessity to manage and facilitate online feedback procedures (Ibrahim et al., 2021). In the process, although students' skills in hands-on exercises were inhibited, their skills in using digital design tools were gradually fostered. Before the pandemic, students of architecture were generally used to adapting to digital technologies after the first year; however, with online education, they adapted to these technologies in advance in the first year, though they also had some adaptation problems in this process (Alnusairat et al., 2021; Akçay Kavakoğlu et al., 2021). Nevertheless, the early start of the said adaptation problems may also be considered as a situation that will relieve students the consecutive years from the burden of learning digital technologies (Özkar, 2007; Uysal & Topaloğlu, 2017).

However, there are also criticisms focusing on that, in the disciplines of design, digital tools cannot substitute physical ones by which students can develop their reflecting and crafting skills, be aware of what they design in detail, and test/check the product to discover the problems, as also mentioned by Richard Sennet (2008). To solve the conflict between the tendencies to use digital and physical tools in design education, we need to conduct more trials in curriculum structures to keep both techniques together and intertwine them symbiotically (for a trial, see Strand & Nielsen, 2018). In this scope, the current study attempts to propose a curriculum based on the use of digital and physical representation techniques in the first semester of basic design education in architecture on the basis of Halliday's (2004) metafunctions.

To answer the emerging needs in basic design studios by the pandemic and online education, the use of digital tools has been accelerated recently in architecture departments in Turkey, and in face-to-face education, too, students have begun to adapt to these tools in the first year. There is an immense number of studies trying to evaluate the integration of digital tools into design education (Gu et al., 2010; Junk & Matt, 2015; Strand & Nielsen, 2018), into architectural design education (Gross & Do, 1999; Achten, 2003; Al-Qawasmi, 2005; Bailey, 2005; Oxman, 2008; Özen Yavuz & Yıldırım, 2012a; Kara, 2015; Życzkowska & Urbanowicz, 2019) and into first-year design education in architecture (Caldwell & Woodward, 2012; Özen Yavuz & Yıldırım, 2012b; Uysal & Topaloğlu, 2017; Özgen et al., 2021). This final literary axis opens new ways to highlight, try, integrate, and evaluate digital tools in the basic design and helps the instructors structure curricula in an open-minded and innovative way.

The current study, therefore, attempted to propose a new curriculum based on the integration of Halliday's (2004) ideational, interpersonal, and (con)textual metafunctions into basic design learning. This structure was designed (con)textually using digital and physical representation techniques in

the first semester of the basic design curriculum in architecture through the face-to-face education system. At the end of the semester, we also conducted a survey with the students to learn their tendencies and awareness in using the proposed tools. Since the basic design education in Turkey generally follows the traces of the Bauhaus School—as we also had the same perspective in the curriculum we structured—our trial also bridges between the use of digital tools and the physical craft-oriented focus of the Bauhaus but mainly aims at linking the conceptual learning to one of the architectural practices to provide a more continuous basis for both basic design and architectural education. Hence, the integration of conventional physical techniques into digitalization to establish a (con)textual metafunction for the basic design language may provide us with an adequate ground to structure the metafunctional basic design learning/teaching model, which, when applied in face-to-face education, may also compensate for the lack of communicational tools by establishing different modes of communication at the heart of the system.

2. Basic design education, linguistic metafunctions, and digitalization

2.1. Background of basic design studios

Basic design studios in architecture education help students develop a strong foundation in the fundamental principles and skills required for successful architectural design. The architectural education landscape in Turkey is diverse, with schools adopting a range of curricular approaches. Some institutions prioritize building design and technology from the outset, while others experiment with innovative methods like incorporating theatrical performances or experience-based spatial design (Aytaç-Dural, 1999; Caner Yüksel & Dinç Uyaroğlu, 2021). However, the traditional Bauhaus approach remains a popular and prevalent model in many Turkish architecture schools (Çetinkaya, 2014; Makaklı & Özker, 2016). These studios are generally formed through the concept-, composition-, Gestalt-, and workshop-based understanding of the Bauhaus school, integrating design into techniques, and are taken in the first year through two semesters (Farivarsadri, 1998). Therefore, students are prepared for a more realistic realm of consecutive years by passing through conceptual training. The first semester of this year generally aims to teach the fundamental aspects of basic design comprising the elements (such as line, shape, plane, color, texture, and space) and principles of design (composition principles such as balance, contrast, rhythm, hierarchy, and unity, and the Gestalt principles such as figure and ground relationship, similarity, proximity, closure, and continuity), and volumetric and spatial comprehension (through spatial relationships and organizations by considering factors like scale, proportion, direction, and volume) (Acar, 2003). In the second semester, students mainly learn about architectural terminologies and concepts (such as function, circulation, materials, spatial program, site planning, and basic structural principles) and how to integrate this knowledge into the ones they learned in the first semester. On the other hand, the training in representation and visual communication skills (through drawing exercises, model making, and digital tools), and critical design thinking and problem-solving (with an emphasis on creativity, research, analysis, and iteration/revision for innovative solutions) continues over two semesters in the first year.

In this regard, basic design corresponds to a fundamental studio in the design curriculum of architecture education, and it has a very dynamic historical background (Salem & Dündar, 2020). Some aspects of this curriculum date back to the pre-20th century, while curriculum designs similar to the current ones are newer, emerging in the 1920s. We can find traces of training in architectural composition in the period coinciding with the pre-20th century; however, this education emphasized historical styles and (neo) classical proportions, and encouraged students to learn through copying and replicating the traditional forms with limited creativity. At the beginning of the 20th century, we may also recog-

nize a transitional period before reaching out to the rules of Modernism rejecting tradition. Howard Robertson's (1924) *The Principles of Architectural Composition* written in 1924 exemplifies the tendencies toward architectural design in this transitional period; thus, we can still feel the importance of the conventional composition principles such as unity, contrast in forms and masses, scale, and proportion in Robertson's (1924) prominent work, while also coming across the modern emphasis on function, and the relation between plan and elevation.

On the other hand, the emergence and dedication of 'Basic Design' courses in the architecture curriculum occurred through the inspiration of the Bauhaus school, founded by the architect Walter Gropius in Weimar, Germany, in 1919. The school aimed at combining design with industry, theory with practice, and arts with crafts. 'Art and Technology: A New Unity' (*Kunst und Technik: Eine neue Einheit*) as through the words by Gropius (Kaplan, 1995), this unifying model was conducted with a collaboration of an artist or form master teaching theory and a craftsman teaching technical processes with techniques through workshops (Salem & Dündar, 2020). By following the joint principles prevailing in both the arts, design, and architecture, the new integrative spirit of the Bauhaus had strong interdisciplinary bounds linking architecture and design education with the education of different visual art branches (O'Sullivan, 2012). Also, regarding this interdisciplinary context, some educational models formed the basis of the Bauhaus; however, it could be a prominent example by being classicized through the early- and mid-20th century (Cross, 1983). Two of the other leading schools contemporary to the Bauhaus were the French Ecole des Beaux-Arts and the Russian Vkhutemas; nevertheless, they differed from the Bauhaus in terms of practicality, the effectiveness of design, and reach to the masses (Oxman, 2001). Turning into a movement, Bauhaus emphasized a more holistic design approach, focusing on fundamental design principles and experimentation.

After the closure of the Bauhaus in 1933, the effects of the school continued in the education plans of architecture departments, even if some concepts have been transformed and reproduced to adapt the education plan to the changing conditions (Conant, 1965; Orr, 2021). The basic design studio, shaped by the Bauhaus approach, turned into a field of experiments on visual language, and its educational structure was dismantled and rebuilt with the exercises to feed the universal basic design language based on the Gestalt and composition principles through hands-on exercises (O'Sullivan, 2012). Though the integration of digital tools in this almost classical approach has not harmed the logic of the language, it has the potential to change the representation and expression methods permanently.

2.2. Systemic Functional Linguistics and design education

The approaches and studies to the cognitive phases of making design were widely influenced by the theory of Systemic Functional Linguistics (SFL) by Halliday (2004), who argues here about mainly two opposing metafunctions of language, ideational and interpersonal. Accordingly, the *ideational* (reflective) level refers to the reflection phase through which people concentrate on a more conceptual stage and try to communicate by themselves through concepts and ideas (Halliday, 2004). Besides, the ideational metafunction is composed of two sub-functions, the *experiential* and the *logical*: in the experiential function, we refer to the world of experience through the linguistic representations of participants, processes, and circumstances, while the logical function forms how we structure and organize propositions linguistically, and shows how we connect ideas and propositions to provide logical relationships between them (Halliday, 2004). In contrast, the *interpersonal* (active) level corresponds to a participatory phase through which people communicate with other persons (Halliday, 2004). This metafunction points out dialogues between speakers and listeners (writers

and readers, designers and clients, or students and instructors) and relates to how we create social interaction and establish relationships with other people linguistically (Halliday, 2004). Moreover, Halliday (2004) also highlights a final third function, the *textual*, which provides a joint base for the other two metafunctions but also stands apart from these acts. The textual metafunction does not deal with the stages of having experience, establishing logical relations, and social interaction. It concentrates on how language is organized to compose a cohesive and coherent text (Halliday, 2004); it has a structural basis and defines the *context*.

The existence of such a linguistics model can also be followed in design language; that is, the experiential phase of the ideational metafunction may correspond to how designers reflect on their experiences and observations while, for example, making design sketches to propose ideas. The reflections of a designer on an idea also have connections constructed in the logical phase within the design proposal to build a reasonable structure. Afterward, to convey the design ideas and proposal to others, designers need to establish strong and legible communication with others at the interpersonal level. Finally, on the textual level, the design context created or the project itself as a (con)text serves designers to show the structure of the design language that they produced. It refers to organizing architectural elements and parts to create a meaningful whole. Therefore, we may claim that Halliday's (2004) SFL works through the design language, as well, and builds the design process from the very preliminary and reflective stages of design to the interpersonal communications and the construction of the end product as a (con) text.

There are examples in the literature highlighting this connection between Halliday's (2004) SFL and design language (in digital or physical regards). In this framework, Andrew Dong (2007, p. 5) discusses whether 'language itself participates in the enactment of design' and denotes that 'Forms of semantics and grammatical structures of design text are lines of compositions through which these performative aspects enact design practice and actualize the designed work'. Referring to Halliday's (2004) *An Introduction to Functional Grammar* and Halliday's and Christian Matthiessen's (1999) *Construing Experience Through Meaning: A Language-Based Approach to Cognition*, Dong (2009) strongly underlines the possibility of integrating SFL and metafunctions of language into design by also examining the systems of *transitivity* (in the ideational level) and *appraisal* (through the interpersonal exchanges). In Dong's (2009) proposal, the transitivity works in 'material', 'mental', 'behavioral', 'relational', and 'existential' contexts—excluding the 'verbal' regard. The grammatical choices in the appraisal context of language, on the other hand, correspond to the expressions of 'evaluation', 'attitude', and 'emotion' through which an interpersonal communication can be staged (Dong, 2009). All these phases and contexts are observable in any of the design processes.

The importance of examining language systems by suggesting connections between linguistic systems/grammars and visual/verbal representations of design process is legible through literature, however, its examination regarding design studios is rarely undertaken in academic studies. Thus, SFL may also be applied in the design education process in architecture schools. A trial in this regard uses the SFL's metafunctions to structure a 3rd-grade architecture studio curriculum based on the intertwined relationships between the ideational conceptual (visual) sketches and interpersonal (verbal) exchanges of design ideas through a continuous review system covering the whole term (Çıkış & Ek, 2010). Stefano Moroni and Giuseppe Lorini (2021) examine drawings as a linguistic tool by analyzing the (meta)functional stages of this communication model by referring to Halliday's (1973) *Explorations in the Functions of Language*. In a similar perspective, Chahid Akoury (2020) also refers to Halliday's (2004) metafunctions and highlights the importance of drawing as a language to be utilized in introductory design stu-

dios to develop students' perceptual and expressional abilities in creative and critical design thinking and communicating. The works show that the bonds between the linguistic/grammatical systems and visual/verbal representations are strong, and these systems can be followed functionally in the education of design in architecture. Therefore, we may apply these systems in functional regard both in in-person and online education systems and try to establish new curricula adapting physical and digital technologies by providing a hybrid context concerning techniques.

2.3. Digitalization as the (con)textual metafunction of basic design language

Today, digitalization in design curricula is an indispensable part of the education system. Therefore, fate was introduced using digital tools in design, and students were required to learn the tools and improve their skills in using digital technologies to make them express their ideas more efficiently (Oxman, 2008). Here, the problem was about the effects and areas in which the digital tools were applied: if these tools were used in the brainstorming or conceptual stage of the design process, it was criticized by the scholars believing in the practical and reflective relationship between the head/mind and the hand of the designer (Sennet, 2008; Kara, 2015; Vetlesen, 2015), and the ones highlighting the inconvenience to trace back the different design stages produced in the digital environments because most of them are not saved by the students (Al-Qawasmi, 2005). On the other hand, if the digital tools are utilized only during the representation phase, it was positively interpreted (Özen Yavuz & Yıldırım, 2012a), or it was stated that there is not any considerable difference between the two thinking/producing modes (Brandon & McLain-Kark, 2001). However, there are also views supporting the use of digital tools in the design thinking process to substitute the physical/manual procedures—if the project is open to be worked, for example, in algorithmic or parametric design languages (Gross, 1999; Bailey, 2005; Gu et al., 2010; Özen Yavuz & Yıldırım, 2012b; Oxman, 2017a; Oxman, 2017c; Strand & Nielsen, 2018).

Furthermore, the rise of digital technologies did not begin during the pandemic; it has a longer story connected to the emergence of the need for a theoretical search as a frame for the accelerating use of digital tools in the design process (Oxman, 2006). Although the subject of the design process with digital/computational tools in practical respect is controversial in the literature, there are potent attempts to compensate for the theoretical lack of using and adapting computational tools and digital media into architectural design processes. In this regard, a crucial discussion about computational tools was undertaken by Rivka Oxman (2017a) in her article on *parametric design thinking* and its impact on the design process. According to her, parametric design tools utilizing algorithms and user-defined rules influence design thinking (Oxman, 2017a). At this point, we may also claim that design thinking has always been a parametric process in itself; the only difference is that in traditional regard, the aim has been to produce a final form or image in the end, while in parametric design thinking, the aim is the design process itself. Here, Oxman (2017b) also takes attention to this critical topic about the relationships between the image and computational design process by stating that instead of *processing the image*, that is, the traditional method treating the image as a static end-product utilized for analysis and representation in the design process, *imaging the process* can be the answer to follow a dynamic design evolution through computational design tools that generate the image directly from the design process itself and convert it into a dynamic output reflecting the design's development.

Regarding controversies in the practice-based discussions, on the other hand, some of the researchers (Al-Qawasmi, 2005) stated that it is compulsory to integrate digital technology into architectural education in the early stages, but some of them are on the opposite side (Kara, 2015; Lawson, 2002; Hertzberger, 2005; Sennet,

2008; Pallasmaa, 2011). Juhani Pallasmaa (2011) stated that digital tools cannot replace traditional tools because of the cooperation of hand, tool, and mind. Hand and mind interaction is a common and essential research subject, as Pallasmaa (2011) and Herman Hertzberger (2005) analyzed this interaction and its effect on the design process. Bryan Lawson (2002) stated that when the creativity of digital tools is analyzed for students, there are many impressive and strong presentations with poor design. He compared computers and humans in some tasks, concluding that computers are quicker and more reliable in calculations and remembering (Lawson, 2002). However, the human mind is better at recognition and interpretation, which protects designers from poor designs, as Hertzberger (2005) described in his speech as 'fake' rather than 'real' creativity. Amjed M. Ali and Hawar Himdad's (2015) research concluded that, in architectural education, the design process is more important than the end product, and students should take information from many different fields in the process. Strong dependence on digital tools has negative indicators on the design process. Also, there is a relationship between drawing capacity and creativity. However, the balance between digital and conventional physical tools should be kept together for the students' future experiences.

Glenda Amayo Caldwell and Sarah Woodward (2012) claimed that the advantage of using digital tools in the early stages of design is that students gain confidence by learning CAD software. Still, digital tools are not sufficient in the creative idea-creation stage. Levent Kara (2015) noted many advantages of using digital tools in the design process, such as enabling the design of structural and formal geometries, making the design and construction process clear, and preparing the students for future needs. However, deciding where and how to implement these tools in the curricula is important because it makes a real difference. He states that '[...] these tools still require an internalized knowledge of seeing, thinking, and making space which cannot be cultivated through digital environment alone' (Kara, 2015). Students who used digital tools in the design process in later years have the advantage of interchanging conventional and digital tools and dealing with architectural complexities.

On the contrary, Jamal Al-Qawasmi (2005) stated that digital tools allow students to work from various views at any point in time. In the conventional design process, students make technical drawings to represent their designs at an interpersonal level. However, they explore and articulate the design from 3D models in the digital process. The physical models used by the students are replaced by virtual 3D models with the use of digital tools, and that change makes the process more responsive, which is another advantage of using digital tools. Changes in the solids/voids, color, and texture can be made immediately, and the process becomes interactive and interpersonal. Using 3D design tools, students can easily immerse themselves in their design and simulate the environment and user. The digital design process can be, therefore, described as reflective (ideational), interactive (interpersonal), integrative, and immersive (Al-Qawasmi, 2005).

Even though there is controversial research about using only digital tools in the early stages of the design process, the idea of including digital tools in the curricula is compromised by many researchers. Without leaving the advantages of the conventional physical learning tools and environment, utilizing digital problem-solving and representation in design may also lead instructors to integrate basic design and architectural education easily. Thus, in the sense of Halliday (2004), digitalization integrated into conventional physical design representation media may serve as a metafunction, which refers to a kind of (con)textual plane through which the ideational/reflective/passive, transitional and interpersonal/(inter)active levels can meet on a continuous and stable ground, in the language of the basic design.

3. A trial for a new curriculum model in basic design language

Basic design studios in Turkey usually cover the first academic year. Therefore, these studios play a vital role in the early periods when a format is introduced to first-year students in professional education. The current study was undertaken in the first semester of the Basic Design in Architecture I studio in the Department of Architecture at Yaşar University. The basic design education covers the first year (two semesters), and the first semester is reserved for teaching the fundamental principles of design following a curriculum having the Gestalt, composition, and organization principles at the focus mainly to feed the conceptualization in basic design language. After returning to face-to-face education in the fall semester of the 2021-2022 academic year and witnessing the advantages of digital tools during online education in the previous year, we tried to integrate digital tools into the design process in the new education period. Accordingly, the curriculum was re-structured to balance the hands-on exercises with those digitally produced to increase students' brainstorming abilities and communication potentials and, thus, to support the ideational (conceptual) and interpersonal (communicative) metafunctions of basic design language. In this way, we aimed to provide preliminary knowledge through a training model allowing the use of digital tools and physical representation techniques together in the design processes to design a smooth transition from the basic design studio of the first year with a relatively abstract and conceptual basis to the consecutive years of architectural education having a more concrete basis.

In the search for a new model, on the other hand, when we translate the metafunctions of language, as defined by Halliday (2004), into the curriculum of basic design, we have a base to bridge the gap between the abstract and concrete phases. Accordingly, we designed the curriculum in four intertwined modules. The first one emphasized the ideational level by encouraging the students to reflect upon the basic principles of design, and in this stage, observations, sketches, analyses, and diagrams referred to the fundamental representation techniques. The second module was transitional, bringing together conceptual thoughts and digital and physical craft-based practices by supporting the students in expressing their designs in the concrete stages; thus, conceptual sketches and technical drawings were utilized in the transitional phase. Thirdly, through the interpersonal level, the requirements covered design descriptions and brief narrations about the projects to support the technical drawings and models and to facilitate communication. In this structure, the textual stage of Halliday (2004), fourthly, was translated into a drawing- and modeling/model-based language of basic design to connect all the other three stages in the same context—therefore, we called it (con)textual level, which is open to the integration of the conventional representation techniques with the digitalized ones.

54 students and 5 instructors participated in this exercise-based process. Throughout the term, by utilizing the metafunctions defined in SFL (Halliday, 2004; Halliday & Matthiessen, 1999), the students participated in the exercise sections beginning with the ideational phase, evolving through the transitional one, and finalizing with the interpersonal phase. This tripartite set has been repeated through four cycles during the term (Table 1). Moreover, when the exercises defined new content and changed the previous context, we designed the assignments to inform the students about these changes in the context. Therefore, (con)textual structure of the exercise language is accompanied by the ideational, transitional, or interpersonal phases. In the ideational parts of the exercises, we mentioned in the related written assignments that they need to reflect on the design problem, describe it through writing, and make sketches of brainstorming for probable solutions in digital and/or physical realms. When we required them to make design representations through new techniques (such as collages, poster designs, or digital models), these ideational sketches/writings developed

through newly introduced (con)textual phases—such as the ones labeled 'ideational + (con)textual' in Table 1.

Moreover, some exercises provided possibilities for a transition between the ideational and interpersonal phases of the design assignment. In the transitional exercises, we noted in the written assignments that the students need to transfer their reflections, sketches, and representations to a level requiring a stronger communicative ability covering the technical drawings with analytical and informative details about the measurements, sizes, types, colors, and materials. They could work in digital and/or physical regards. Therefore, while trying to translate/transpose the preliminary designs into a more concrete stage, the students could establish a design language that has the potential for interpersonal communication. Again, when we asked them to introduce a new representation tool for this transpositional process, we double-coded this level of exercise as 'transitional + (con)textual', as also demonstrated in Table 1.

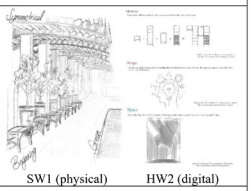
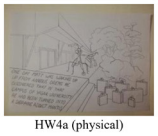
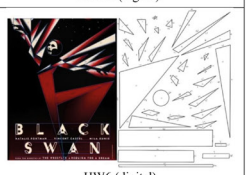
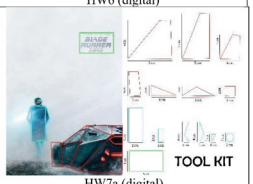
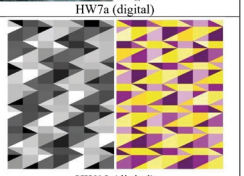
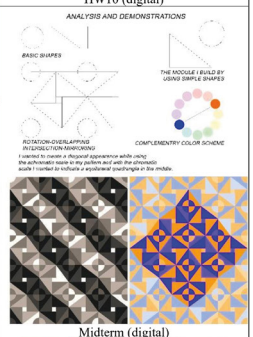
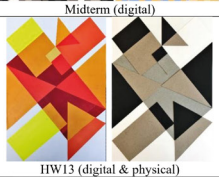
In the interpersonal phase, the students received the message through the written assignments that they needed to complete their designs by finalizing the representations with all details and analytical expressions to ease interpersonal communication. We also required them to convey their ideas verbally in written and oral forms to accompany their detailed drawings. In these phases, they were also allowed to utilize digital and/or physical tools to facilitate conveying and exchanging design ideas. Although it occurred only two times, interpersonal phases could overlap the (con)textual ones, as well—as marked 'interpersonal + (con)textual' in Table 1—if we required them to make the final representations of their designs in the design contexts that they learned recently. In these cases, they utilized these new representation contexts/techniques only to ease the communicative level about their design ideas and to broaden the understanding ability of the other people about their designs—which means that they did not use these contexts/techniques in the ideational or transitional phases.

Therefore, the (con)textual definitions in the proposed model always accompanied the other metafunctions and metafunctional relations. Moreover, these (con)textual definitions construct the body of the assignments composed of our curriculum base, aiming to connect digital and physical tools. Within this scope, the structure of the semester with the assignment contents, design-tool definitions (digital/physical), and representation preferences (digital/physical) of the submissions are classified regarding Halliday's (2004) metafunctions, as given in Table 1.

Each exercise set included all ideational, transitional, and interpersonal levels of design, and some exercises were designed as the rule teachers introducing the students to some specific research and design methods and representation techniques; hence, we called them the (con)textual, in Table 1, to refer to that a change in the context/technique was introduced with the related assignment. The studio works covered the daily exercises the students performed during the studio hours, and the homework assignments were the exercises studied after and before the studio classes. The works supporting the ideational function comprised the sub-assignments with a lower percentage (20%) and were graded either over four points or with plus (+) and minus (-) according to the content and duration of the design. Aiming at facilitating interpersonal communication, there were also exercises graded over 100 points, and they corresponded to the primary assignments (Set1, Set2, and Set3), midterm, and final grades with a higher percentage (80% in total) in the term grade.

As seen in Table 1, the assignment structure of the studio was organized in a balanced way regarding the ideational, transitional, and interpersonal metafunctions and frequency of using the digital and physical design tools in the design thinking and representing stages, as the (con)textual metafunction. As the two poles, the assignments of the ideational phase majorly covered the first part of the semester, while the ones of the interpersonal phase were

Table 1. *The distribution of the content, design-tool definitions, and representation preferences of the submissions in the assignment structure and works with the highest grades classified regarding the design tools and metafunctions.*

Week	Meta-functions	Title (studio work/homework) and content	Design tool/ Number of Submissions				Student works with the highest grades
			Digital		Physical		
1	Ideational + (con)textual	SW1: Observation by sketching		0	•	42	 SW1 (physical) HW2 (digital)
		HW1: Observation, analysis, research	•	41	•	45	
		HW2: Analysis, research	•	44		0	
2	Transitional	SW2: Transformation		0	•	45	 HW2 (mixed)
		HW3: Analysis, transformation, synthesis	•	57	•	26	
	Interpersonal + (con)textual	SW3: Analysis, visual narration	•	44		0	 HW4a (physical)
	Interpersonal	HW4a/HW4b: Synthesis, analysis, visual narration	•	32	•	13	 HW4b (digital)
			•	44		0	
3		SW4: Analysis, visual narration	•	47		0	 HW6 (digital)
	Ideational + (con)textual	HW5/SW5: Abstraction	•	47		0	
			•	45		0	
	Ideational	HW6: Abstraction, decomposition	•	47		0	
4	Ideational + (con)textual	SW6: 2D module composition		0	•	43	 HW7a (digital)
	Ideational	HW7a/b: Decomposition, 2D module composition	•	85	•	19	
		SW7: 2D module composition		0	•	46	
	Transitional + (con)textual	HW8/SW8: Pattern design	•	48		0	
				0	•	48	
5	Transitional	HW9/SW9: Achromatic pattern design	•	48		0	 HW10 (digital)
			•	48		0	
		HW10: Achromatic and chromatic pattern design	•	47		0	
6	Interpersonal	SW10/Midterm: Achromatic and chromatic pattern design and analysis with descriptions	•	47		0	 Midterm (digital)
			•	50		0	
	Ideational + (con)textual	HW11: Composition principles, research	•	46		0	
7		SW11: 2D composition		0	•	39	 HW13 (digital & physical)
	Transitional	HW12/SW12: Achromatic 2D composition		0	•	40	
				0	•	40	
		HW13/HW14: Achromatic and chromatic 2D composition		0	•	26	
			•	36	•	36	

mainly given in the second half of the semester. Accordingly, 18 assignments were arranged to encourage the students to reflect upon the design problems and make sketches, collages, and visual narrations to figure out the potential design ideas at the conceptual level. 11 assignments were studied in the digital context, and 12 covered the physical representation context for the derivation of design ideas, while in 6 assignments, the students were required to use both digital and physical contexts. 10 assignments, on the other hand, were composed of the integration of ideational and (con)textual metafunctions. Thus, we introduced the students to different representation contexts/techniques such as observation by sketching, analysis, research, abstraction, digital design, and 2D and 3D composition principles.

16 assignments referred to the transitional function with the representation manners to translate the ideas derived in the ideational phase to the interpersonal phase. 10 of these transitional assignments were designed to require the submissions in digital respect, 12 of them corresponded to the representations produced in the physical context, and 6 entailed both digital and physical works. 3 exercises required the introduction of the (con) textual metafunction intertwined with the transitional one, through which the students learned how to produce and translate a pattern in 2D and composition in 2D and 3D environments.

The interpersonal phase covered 20 assignments and was designed to advance the representation techniques of the students to communicate with others through digital drawings, modeling, and physical models. 18 were worked in the digital context, 13 assignments required physical submissions, and 10 included digital and physical submissions. Again, only 3 assignments were designed to cover both the interpersonal and (con)textual metafunctions by which the students could use the techniques of analysis, visual narration, and design of a relief composition with the tactile texture to represent their design ideas for providing communication interpersonally. In this respect, as the rule-definer, the

(con)textual metafunction, supported by the ideational, transitional, and interpersonal phases, was composed of physical and digital languages introduced as integrated into 9 assignments.

In total respect, the students were required to make only physical submissions in 15 assignments, digital or physical (optional) submissions in one assignment, submissions by the mixed technique (collage via digital and physical tools) in two assignments, only digital submissions in 16 assignments, and submissions in both types of representation techniques (digital and physical) in 6 assignments. Therefore, the assignments included 37 physical options/requirements, while 40 submissions had the option/requirement of using digital tools in the design process. However, the students mainly preferred to use digital tools, as seen in the distribution of the total number of submission types: 1885 submissions out of 3271 (approximately 57,62%) were prepared and represented in the digital environment.

The semester started with the ideational phase and physically applied design techniques (sketching) and continued with collage as a mixed technique open to the use of both hand sketches as a base and putting marks, making analyses, and superimposing texts or images on these sketches in the digital environment by covering the ideational, transitional, interpersonal, and (con)textual phases. Toward the end of the semester, all drawings (orthographic projections) and perspective representations (models) were produced by 2D and 3D digital design programs, and all these submissions were accompanied by a physical model to provide stronger communication at the interpersonal level. Except for the first week of the ideational level, when the students did not know how to use the digital programs, they preferred to design only in the digital environment (as seen in HW1 in Table 1), even if, in the assignment, physical submission was also required. And, if the type of the design tool was optional in the assignment, the students, again, mostly preferred to use the digital (2D and/or 3D) tools (as seen in HW3, HW4a, HW7a/b, SW23, SW24, and SW25 in

Table 1. *The distribution of the content, design-tool definitions, and representation preferences of the submissions in the assignment structure and works with the highest grades classified regarding the design tools and metafunctions (continued).*

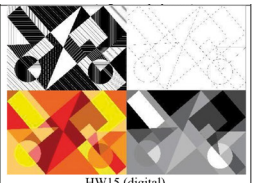
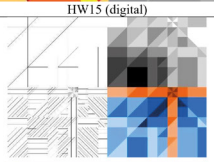
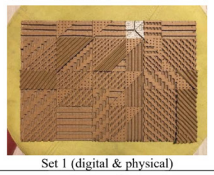
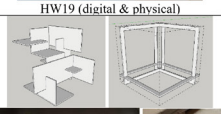
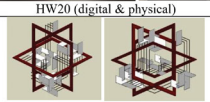
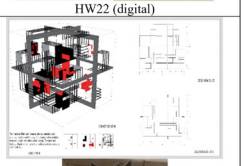
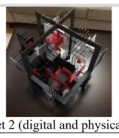
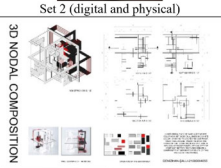
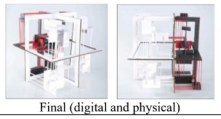
8	Interpersonal	SW13: Chromatic 2D composition		0	•	37	 HW15 (digital)
		SW14: Achromatic and chromatic 2D composition	•	42		0	
		HW15: Achromatic and chromatic, visually textured 2D composition	•	45		0	
9	Interpersonal + (con)textual	SW15/SW16: Relief composition with tactile texture		0	•	23	
				0	•	44	
	Interpersonal	HW16/Set1: Achromatic and chromatic, visually textured 2D composition and relief composition with tactile texture	•	44	•	44	 Set 1 (digital & physical)
			•	44	•	44	
	Ideational + (con)textual	HW17: 3D digital design programs, research		0		0	
10		SW17/HW18/SW18 : 3D module composition		0	•	44	
				0	•	45	
			•	42	•	42	
		HW19: 3D module composition and 2D frame design	•	86	•	43	 HW19 (digital & physical)
11	Ideational	SW19/HW20: 3D module composition, 2D frame design, 3D volume design	•	88	•	44	
			•	76	•	76	
	Transitional	SW20: 3D composition (with planer and linear elements)	•	37	•	37	 HW20 (digital & physical)
		HW21/SW21/HW22: 3D nodal composition	•	41	•	41	
			•	45	•	45	
			•	40	•	40	
12	Transitional + (con)textual	SW22: 3D composition, 2D representation of the composition	•	32	•	32	 HW22 (digital)
	Interpersonal	HW23/SW23/HW24/Set2/SW24: Achromatic and chromatic 3D composition, 2D representation of the composition	•	39	•	39	
13			•	37	•	15	
			•	35	•	35	
			•	43	•	43	 Set 2 (digital and physical)
			•	33	•	12	
14		SW25/Final: Achromatic, chromatic, visually- and tactile-textured 3D composition, 2D representation of the composition	•	37	•	5	
			•	48	•	48	
		Set3: Archive of the term (portfolio)	•	48		0	 Final (digital and physical)
Total number of submissions (3271):				1885		1386	

Table 2. *The survey questions with the distribution of answers.*

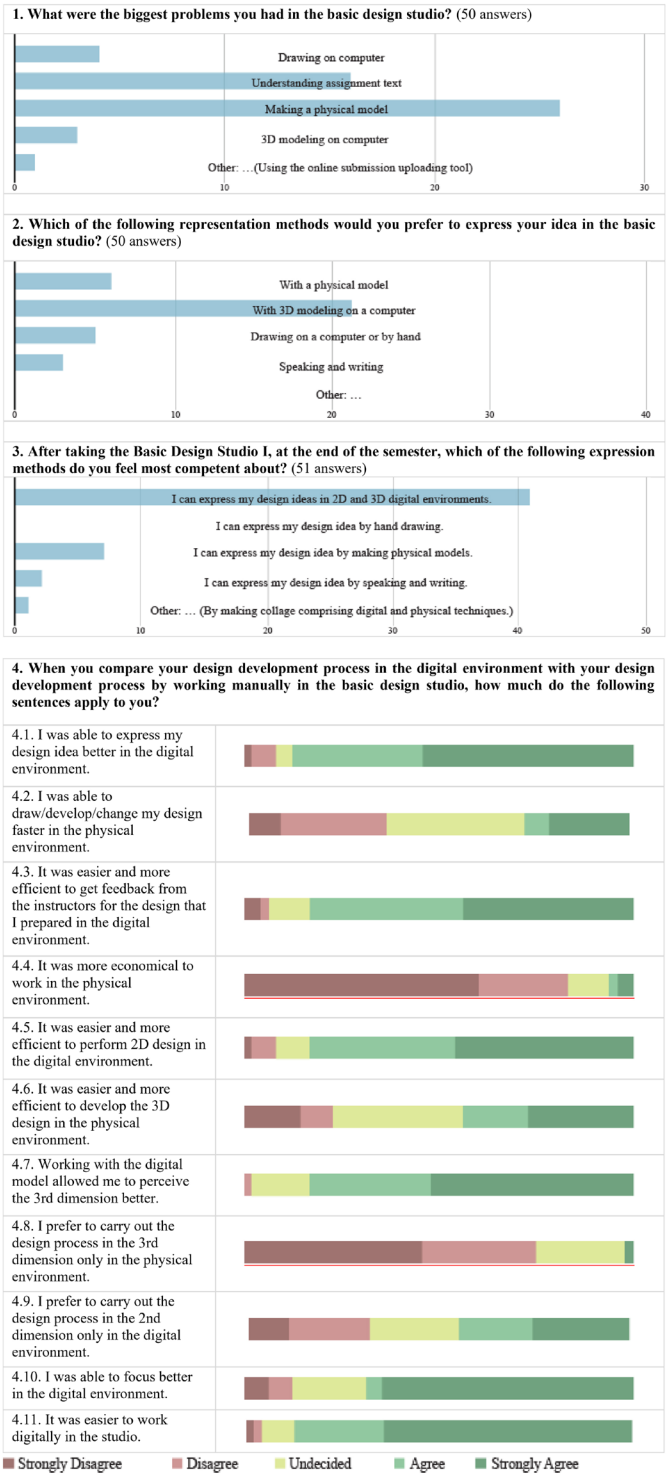


Table 1), and the results even, for the works with the highest grades, were more successful in the digital submissions in terms of the design qualities at the interpersonal level, which can be seen in Table 1.

Observing the students' tendencies and results, we decided to survey them to understand their preferences, abilities, and thoughts about using different design and representation techniques in the exercises through all metafunctions. The survey comprised 14 questions on the multiple choice and Likert scale (with 5 options), and we tried to comprehend their preferences regarding utilizing physical and digital tools in their design works. Regarding the students' preferences about using digital or physical design tools in the exercises to develop, translate, and express their design ideas, we can see that most of the answers are on the side of using digital design tools (Table 2).

In the answers to the first question, we may see that the problem of 'making a physical model' corresponds to the highest score in ideational and interpersonal regard. Because craftsmanship techniques necessitate a level of skill, knowledge, and patience to learn and apply, the students could not quickly adapt to use them at the ideational stage at the beginning of the semester. However, even after they learned those techniques, they continued to prefer to utilize digital design and representation techniques through the interpersonal phase, which may be explained by the dispositions of their generation, which is much more familiar with information and communications technologies. Being accustomed to the fast-flowing world on internet pages, showing patience while making models, and improving their skills could be more difficult. The score of this answer was followed by the score of the (con)textual problem related to 'understanding assignment text', which can be combined with the fact that the education language of the Department is English.

In the second question, 72% chose to express their design ideas interpersonally with 3D modeling on a computer when the students were asked to prefer a representation method. The other three options, which have similar percentages much less than the favored answer, indicate individual differences rather than a generalizable outcome. If the options are to be compared to each other, we see that while working in 3D through all metafunctions, the digital environment is preferred by the students rather than making a physi-

cal model, which fits with the answers and evaluation of the first question. The students choose to work through modeling in 3D rather than drawing to express their ideas ideationally and interpersonally, even in the digital environment. We observe that with 3D modeling on the computer, students can develop faster and more easily modify a design idea with ideational respect. Expression of the idea by speaking or writing is not preferred interpersonally by the students, which is partly understandable as the outcome of the design process would be a physical one, either developed digitally or manually. However, we believe that the change in the preferred communication skills of the generation, the students being more confident and capable through digital tools at transitional and interpersonal levels, rather than speaking or writing, is also an essential reason for this.

In answer to the third question, 80% of the students chose 2D and 3D digital environments as their most competent method to express their design ideas interpersonally, while 14% chose to make physical models, 6% chose speaking, writing, or collage, and none of them decided hand drawing. Considering the balanced usage of the digital and physical design tools in the assignment structure of the studio and that it was the first semester of the students' design education, meaning, in general, every method was new, we can say that the students can learn ([con]textually) and develop (ideationally) digital-tool usage skills much faster and easier than manual working skills. Again, this can be explained by the general feature of the generation, the students being born into the digital age, using different digital tools in every stage of their lives for communication, education, entertainment, and even for socializing; the digital environment is what they are accustomed to, rather than manual working environments.

The fourth question had 11 sub-sentences to be answered on a Likert scale of 5 (Table 2). While the first three questions of the survey asked for a preference from the students, the fourth question asked for a comparison between working in the digital environment and working physically, regarding 11 sentences that each addressed different aspects of the design development process at the ideational and transitional levels. In the answers to the first sentence, most students agreed that they could express their design ideas better in the digital environment than working physically at the interpersonal level. The answers to the second sentence, having an average point of 3.04, corresponding to undecided, show no clear distinction for the students between the digital and the manual working environments when the timing of the work process is considered. The students' answers being almost equally distributed between the sides of disagreeing, undecided, and agreeing indicates that the students are not well acquainted with the timing of the physical/manual process in design. We believe that if the sentence questioned the digital environment, the answers would be closer to the agreeing level, considering the answers to the first and eleventh sentences favor the digital environment.

According to the third, fourth, and eleventh sentences, at the ideational level, most students favor the digital environment in the design development process. Furthermore, they believe that, in interpersonal respect, it was more accessible and more efficient to get feedback from the instructors when the design was prepared in the digital environment, and in terms of economy, they clearly state that it was more economical to work in the digital environment. Also, working in the studio with digital tools was easier for the students. Because the design could be shown to the instructors by the computers, there was no need to take printouts or buy modeling materials, which made the digital environment more economical for the students. With the advantages of digital tools, the students could reflect and modify their design and create different options faster ideationally, even during the (interpersonal) critique time, and could discuss the results simultaneously with the instructors, which made the critique session easier and more efficient for the students. These advantages also made it easier to work digitally in the studio,

where time management is crucial for submitting the studio works, and the physical conditions of the studios are limited to working physically.

When the students were asked about their level of ideational focus during the working process, although the answers were on the side of agreeing for the digital environment with an average point of 3.96, still one-third of the students either disagreed or were undecided about working in digital environments when it came to the focusing issue. We believe this is an important outcome to show that working physically can increase the ideational focus during the design development process.

The sentences from five to nine were prepared to compare working in the digital environment and manually about design development in 2D and 3D at both ideational and transitional levels. A significant difference in the answers between 2D and 3D in terms of working digitally or manually could not be seen, but while the students' answers indicate that it was easier and more efficient to work digitally in 2D, for 3D, the distinction between digital and physical environments is not that clear. The answers are distributed among disagreeing, undecided, and agreeing sides, which shows that the students are unsure about the subject. The way the sentences were structured could have affected the answers given by the students. When the sentence was formed asking about the digital environment, generally, the agreeing level was very high, but when the physical environment was asked, the students were closer to the undecided level. The reason may be that as the students were not accustomed to working physically throughout their lives, they do not have enough experience and knowledge on how the physical working process can come out in terms of quality and timing. As the survey was done in the first semester of their design education, they were still learning the contexts.

Regarding the ideational perception of 3D, most students agree that it is better achieved through working in digital environments. But when it comes to preferring one environment to work in either 2D or 3D, the students want to work both digitally and manually through all metafunctional levels, showing no clear preference in between. They clearly state that they do not want to work only physically in the design development process at the ideational level.

As a general evaluation, the students prefer to work in the digital environment during the design development process at the ideational level. It is easier, more efficient, faster, and more economical for them to work in the digital environment, especially at the interpersonal level. However, they are not against working in the physical environment and favor digital and physical work through the design development, translation, and communication processes.

4. Conclusion

The COVID-19 pandemic that the world has gone through has caused some inquiries. As a result, as in every field, architectural education has several transformations and adaptations. With the start of distance education, there were arguable positive and negative consequences in basic design education (Grover & Wright, 2023). Acceleration and adaptation of digital tools can be counted as an outcome of this pre- and post-pandemic situation. In the first year, students are required to learn and improve their digital skills. However, the problem occurs when using or adapting digital tools in the existing curriculum, especially in the concept development process of the ideational phase and the communication through the representation tools in the interpersonal phase. Using digital technology as the (con)textual metafunction, in Halliday's (2004) sense, in architectural education at the beginning of the process is necessary, therefore, in terms of rapidness and consistency among outcomes of design while conventional tools cannot be substituted with digital ones because of the combination and coordination between hand, tool, and mind/head as another multi-dimensional context.

Therefore, restarting face-to-face education in the 2021-2022 academic year, with the positive outcomes of using digital tools in distance education

in the previous year, as the instructors of basic design studio, we tried to integrate digital tools into the design process and re-structure the curriculum with a pattern composed of the metafunctions of design, to balance hands-on exercises with the digital ones. To see the results of our attempts, we conducted a survey with the basic design students at the end of the semester. This study, therefore, also tries to build insight into students' tendencies to use digital tools through all metafunctions of basic design language. By following an education pattern covering the ideational, transitional, interpersonal, and (con)textual phases alternately with a balance and with the use of both physical and digital tools in basic design, we believe that students may feel more comfortable in the consecutive years to derive, develop, and express their design ideas through all the mentioned phases and by using each type of tools.

Thus, according to the survey results, the basic design students are comfortable with integrating digital tools into the process in terms of focusing on design ideationally, explaining, and representing the design idea interpersonally, as well as they are quite satisfied studying with digital tools in the physical/face-to-face environment. Therefore, the level of responsiveness to digital tools was relatively high among the students because they were able to make changes in color, texture, organization, and shape/form quite quickly at the ideational phase and see the results immediately, which made the process more interactive and facilitated the interpersonal communication.

On the other hand, although they could work with 3D models digitally, they had difficulty understanding 3-dimensionalities and spatial quality in ideational respect. This critical outcome shows that being able to do 3D modeling in a digital environment may not mean understanding all aspects of the 3rd dimension and the phenomenon of space. Thus, we can observe that it may have been partially tricky for students who preferred to use digital tools to feel and understand space and spatiality. As Sennet (2008, p. 274) mentioned, 'The more neuronal stimulation, transmission, and feedback occurs throughout the global geography of the brain, the more we think and feel'. Therefore, it is essential to consider that communication between the head/mind and the hand is the most crucial step towards comprehending space and volume, and it significantly improves the ability to think. However, the survey findings also denote that the students were quite undecided about developing their projects much faster in physical environments at the ideational stage. This may show they were uncomfortable using physical tools such as model making or any other tool requiring craftsmanship. Besides, since students were not used to working physically, they could have difficulty with physical representations, such as making collages or hand-drawing exercises, especially during the ideational phase.

In terms of knowledge, skills, and attitudes, after applying the proposed curriculum, we could observe progress in the students' abilities to design (through the ideational and physical exercises) and communicate (through the interpersonal and both digital and physical exercises). Without dismissing any representation environment (physical or digital), they could be more conscious about their designs' content and develop their skills of comparison, evaluation, and criticism. They could develop a comparative sense related to the contents of the assignments, which may lead to higher success depending on the environment in which they are studied. Before applying this curriculum, in the previous years, although the students could learn the basics of design, they generally had trouble conveying their ideas through drawings, written, and oral regards. With the proposed curriculum, however, the students could also improve their verbal expression abilities via the iterations of the drawn exercises aiming for interpersonal communication.

Considering all findings for a balanced curriculum regarding using physical and digital tools through all metafunctional levels, it may be claimed that the students are undecided about physical design tools while they are quite familiar and comfortable with digital ones. Therefore, in basic

design education, an adaptation of digital tools with conventional ones at the beginning of the design process (at the ideational level), such as in the subject of formal geometries, composition principles, design elements, and organizations, can have advantages for the future experiences of students. Further studies can be conducted to iterate this survey in the upcoming years to see the effects of digitalization on conventional architectural design education. Making adaptations in conventional curricula may pave the way for opening new ways in the old territories to set a balance between the physical and digital tools as well as between the tools and the minds of future designers.

References

Acar, A. (2003). *The Construction and Execution of Beginning Design Education at the Middle East Technical University Department of Architecture Between 1956-2000* [Master's dissertation, Middle East Technical University]. Graduate School of Natural and Applied Sciences, Thesis. https://open.metu.edu.tr/handle/11511/13517

Achten, H. H. (2003). New Design Methods for Computer Aided Architectural Design Methodology Teaching. *International Journal of Architectural Computing*, *1*(1), 72-91.

Akçay Kavakoğlu, A., Güleç Özer, D., Domingo-Callabuig, D., & Bilen, Ö. (2021). Architectural design communication (ADC) in online education during COVID-19 pandemic: a comparison of Turkish and Spanish universities. *Open House International*, *47*(2), 361-384. https://doi.org/10.1108/OOHI-07-2021-0144

Akoury, C. (2020). Apprehending the creative process through drawing in the foundation design studio. *International Journal of Art & Design Education*, *39*(1), 113-125. https://doi.org/10.1111/jade.12223

Al-Qawasmi, J. (2005). Digital media in architectural design education: Reflections on the e-studio pedagogy. *Art, Design & Communication in Higher Education*, *4*(3), 205-222. https://doi.org/10.1386/adch.4.3.205/1

Ali, A. M., & Himdad, H. (2015). The Effect of Conventional and Digital Drawing Tools on Imagination in Architectural Design Education. *Sulaimani Journal for Engineering Sciences*, *2*(1), 27-44. https://mostwiedzy.pl/pl/publication/download/1/architectural-education-and-digital-tools-the-challenges-and-opportunities_41781.pdf

Alnusairat, S., Al Maani, D., & Al-Jokhadar, A. (2021). Architecture students' satisfaction with and perceptions of online design studios during COVID-19 lockdown: the case of Jordan universities. *Archnet-IJAR*, *15*(1), 219-236. https://doi.org/10.1108/ARCH-09-2020-0195

Aytaç-Dural, T. (1999). *Theatre-architecture-education: theatre as a paradigm for introductory architectural design education* [PhD dissertation, Middle East Technical University]. Graduate School of Natural and Applied Sciences, Thesis. https://open.metu.edu.tr/handle/11511/2243

Bailey, R. (2005). Digital Tools for Design Learning. The case of a Caribbean Design Primer for Beginning Architectural Students [Session 3: Digital Design Education]. *The 23th conference on Education in computer aided architectural design in Europe*, Lisbon, Portugal, 131-138. https://scholar.archive.org/work/bfnuiij7k5am7mu2336hbpgole/access/wayback/http://papers.cumincad.org/data/works/att/2005_131.content.pdf

Brandon, L., & McLain-Kark, J. (2001). Effects of Hand-Drawing and CAD Techniques on Design Development: A Comparison of Design Merit Ratings. *Journal of Interior Design*, *27*(2), 26-34.

Caldwell, G. A., & Woodward, S. (2012). First year design 'Visualisation II': The hybridisation of analogue and digital tools. *Procedia - Social and Behavioral Sciences*, *51*, 989–994. https://doi.org/10.1016/j.sbspro.2012.08.275

Caner Yüksel, Ç., & Dinç Uyaroğlu, İ. (2021). Experiential learning in basic design studio: Body, space and the design process. *International Journal of Art & Design Education*, *40*(3), 508-525. https://doi.org/10.1111/jade.12364

Conant, H. (1965). On the education of Artists. *Art Journal*, *24*(3), 240-243. https://www.jstor.org/stable/774699

Cross, A. (1983). The Educational Background to the Bauhaus. *De-*

sign Studies, *4*(1), 43-52. https://doi.org/10.1016/0142-694X(83)90007-8

Çetinkaya, Ç. (2014). Basic Design Education Parameters in Turkey. *HUMANITAS-Uluslararası Sosyal Bilimler Dergisi*, *2*(4), 31-46. https://doi.org/10.20304/husbd.29904

Çıkış, S., & Ek, F. İ. (2010). Conceptualization by visual and verbal representations: An experience in an architectural design studio. *The Design Journal*, *13*(3), 329-354. https://doi.org/10.2752/146069210X12766130824975

Dong, A. (2007). The enactment of design through language. *Design studies*, *28*(1), 5-21. https://doi.org/10.1016/j.destud.2006.07.001

Dong, A. (2009). *The language of design: Theory and computation*. London: Springer Science & Business Media.

Farivarsadri, G. (1998). *An Analytical Re-Assessment of Introductory Design in Architectural Education* [PhD dissertation, Bilkent University IESS]. ProQuest Dissertations & Theses Global. https://www.proquest.com/docview/2665128691?fromopenview=true&pq-origsite=gscholar

Gross, M., & Do, E. (1999). Integrating digital media in design studio: Six paradigms. *Proceedings of the American college schools of architecture conference*. Minneapolis: n.p.

Grover, R., & Wright, A. (2023). Shutting the studio: the impact of the Covid-19 pandemic on architectural education in the United Kingdom. *International Journal of Technology and Design Education*, *33*, 1173–1197. https://doi.org/10.1007/s10798-022-09765-y

Gu, N., Jones, W.M., & Williams, A. (2010). Utilising digital design and rapid prototyping tools in design education. *New Frontiers: Proceedings of the 15th International Conference on Computer-Aided Architectural Design Research in Asia CAADRIA*, Hong Kong, 249-258. https://nova.newcastle.edu.au/vital/access/services/Download/uon:10104/ATTACHMENT01

Halliday, M.A.K. (1973). *Explorations in the functions of language*. London: Edward Arnold.

Halliday, M.A.K. (2004). *An Introduction to Functional Grammar*. London: Hodder Arnold.

Halliday, M.A.K., & Matthiessen, C. (1999). *Construing experience through meaning: A language-based approach to cognition*. London, New York: Continuum.

Hertzberger, H. (2005). *Lessons for students in architecture*. Rotterdam: 010 Publishers.

Ibrahim, A. F., Attia, A.S., Bataineh, A. M., & Ali, H. H. (2021). Evaluation of the online teaching of architectural design and basic design courses case study: College of Architecture at JUST, Jordan. *Ain Shams Engineering Journal*, *12*(2), 2345–2353. https://doi.org/10.1016/j.asej.2020.10.006

Junk, S., & Matt, R. (2015). New approach to introduction of 3D digital technologies in design education. *Procedia Cirp*, *36*, 35-40. https://doi.org/10.1016/j.procir.2015.01.045

Kaplan, L. (1995). *Laszlo Moholy-Nagy: Biographical Writings*. Durham and London: Duke University Press.

Kara, L. (2015). A critical look at the digital technologies in architectural education: when, where, and how? *Procedia-Social and Behavioral Sciences*, *176*, 526-530. https://doi.org/10.1016/j.sbspro.2015.01.506

Lawson, B. (2002). CAD and creativity: does the computer really help? *Leonardo*, *35*(3), 327-331. https://doi.org/10.1162/002409402760105361

Makaklı, E. S., & Özker, S. (2016). Basic design in architectural education in Turkey. *SHS Web of Conferences*, *26*, 01053. Paper presented at the ERPA International Congresses on Education, Athens, Greece. https://doi.org/10.1051/shs conf/20162601053

Moroni, S., & Lorini, G. (2021). Multiple functions of drawings. *Journal of Urban Design*, *26*(3), 374-394. https://doi.org/10.1080/13574809.2020.1801341

Norberg-Schulz, C. (1988). *Intentions in Architecture*. Massachusetts: The MIT Press.

Orr, S. (2021). Art and design: Critical pedagogies and innovative curriculum design. *Art, design & communication in higher education*, *20*(2), 123-127. http://dx.doi.org/10.1386/adch_00034_2

O'Sullivan, N. C. (2012). *Weaving Words and Drawing Lines: The Bau-*

haus Masters Endeavours to Establish a Universal Visual Language within Foundation Education (Master's dissertation, Victoria University]. Open Access Te Herenga Waka-Victoria University of Wellington. https://openaccess.wgtn.ac.nz/articles/thesis/Weaving_Words_and_Drawing_Lines_The_Bauhaus_Masters_Endeavours_to_Establish_a_Universal_Visual_Language_within_Foundation_Education/17000527/1/files/31450315.pdf

Oxman, R. (2001). The mind in design: a conceptual framework for cognition in design education. In Eastman, C.M., McCracken, W.M. & Newstetter, W. C. [Eds]. *Design Knowing and Learning: Cognition in Design Education* (pp. 269-295). New York: Elsevier.

Oxman, R. (2006). Theory and design in the first digital age. *Design studies*, *27*(3), 229-265.

Oxman, R. (2008). Digital architecture as a challenge for design pedagogy: theory, knowledge, models and medium. *Design Studies*, *29*(2), 99–120. https://doi.org/10.1016/j.destud.2007.12.003

Oxman, R. (2017a). Parametric design thinking. *Design Studies*, *52*, 1-3. https://doi.org/10.1016/j.destud.2017.07.001

Oxman, R. (2017b). The role of the image in digital design: processing the image versus imaging the process. *The Active Image: Architecture and Engineering in the Age of Modeling* (pp. 133-155). Philosophy of Engineering and Technology, vol 28. Springer, Cham. https://doi.org/10.1007/978-3-319-56466-1_6

Oxman, R. (2017c). Thinking difference: Theories and models of parametric design thinking. *Design studies*, *52*, 4-39. https://doi.org/10.1016/j.destud.2017.06.001

Özen Yavuz, A., & Yıldırım, M. T. (2012a). Study on defining utilization steps of traditional and digital tools in architectural design education. *Procedia-Social and Behavioral Sciences*, *51*, 239-243. https://doi.org/10.1016/j.sbspro.2012.08.152

Özen Yavuz, A., & Yıldırım, M. T. (2012b). Utilization of digital-algorithmic design tools in architectural basic design education. *Procedia-Social and Behavioral Sciences*, *51*, 307-310. https://doi.org/10.1016/j.sbspro.2012.08.164

Özgen D. S., Afacan, Y., & Sürer, E. (2021). Usability of virtual reality for basic design education: a comparative study with paper-based design. *International Journal of Technology and Design Education*, *31*, 357–377. https://doi.org/10.1007/s10798-019-09554-0

Özkar, M. (2007). Learning by doing in the age of design computation. In Dong, A., Vande Moere, A. & Gero, J. S. [Eds]. *CAAD Futures, Proceedings of the 12th International Conference on Computer Aided Architectural Design Futures, Sydney, Australia*, 99-112. https://doi.org/10.1007/978-1-4020-6528-6_8

Özkar, M. (2017). *Rethinking Basic Design in Architectural Education: Foundations Past and Future*. New York: Routledge.

Pallasmaa, J. (2011). *The Embodied Image: Imagination and Imagery in Architecture*. Chichester: John Wiley and Sons.

Robertson, H. (1924). *The Principles of Architectural Composition*. London: The Architectural Press.

Salem, Ö. G., & Dündar, M. (2020). Re-thinking basic design course in architectural education in Turkey. *Intercultural Understanding*, *9*, 7-14. https://core.ac.uk/reader/356505657

Sennett, R. (2008). *The Craftsman*. New Haven, Conn: Yale University Press.

Strand, I., & Nielsen, L. M. (2018). Combining craft and digital tools in design education for the general public. *Design as a catalyst for change. Proceedings of DRS 2018, 25-28 June 2018, Limerick, Ireland*. Design Research Society, 2689–2700. http://dx.doi.org/10.21606/drs.2018.455

Uysal, V. Ş., & Topaloğlu, F. (2017). Bridging the Gap: A Manual Primer into Design Computing in the Context of Basic Design Education. *International Journal of Art & Design Education*, *36*(1), 21-38. https://doi.org/10.1111/jade.12048

Vetlesen, A. J. (2015). *The Denial of Nature: Environmental Philosophy in the Era of Global Capitalism*. London: Routledge.

Życzkowska, K., & Urbanowicz, K. (2019). Architectural education and digital tools: the challenges and opportunities. *World Transactions on Engineering and Technology Education*, *17*(3), 326-331. http://wiete.com.au/journals/WTE&TE/Pages/Vol.17,%20No.3%20(2019)/19-Zyczkowska-K.pdf