



## MEASURING THE EFFECTS OF A CARTOGRAPHY-BASED PLATFORM ON THE ONLINE DESIGN PROCESS

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### ABSTRACT

As the use of online learning in architectural education has increased, the patterns of the past are now being discussed considering the current pandemic. It is crucial to evaluate the strategies developed in this crisis when the institutional infrastructure, educators, and students rapidly adapt to this context. The use of cartography-based platforms (CBP) as an architectural information communication technology (ICT) enabled tool for interaction, ideation, and evaluation is examined in this research along with its potential and limits. It aims to contribute to the existing hybrid learning ecosystem. Research methodology is developed within the framework of integration, experimentation, and measurement. CBP experiments were modularly integrated into design courses in 2021 and 2022, respectively, and were conducted with the participation of approximately 400 students. In the scope of the course, each student (individually or in groups) is expected to have a field analysis and design proposal for a public space. Measurements related to three main factors and correlations between interface effects on user experience are based on the process, output, and questionnaires. Findings reveal the potential of the CBP strategy, which is implemented practically, to turn crises into opportunities. Statistical results related to measured factors underscore significant effects. Discussions based on the two experiments intensify on systematization, interaction, transparency, and parametrization in the online design process. According to the first experiment's feedback, customization of the interface provides positive results based on an independent T-test. The limitations or changing priorities could be improved with the ongoing experimental applications. Other related studies also support the different variants and widespread impact of the strategy designed and evaluated here. The study shows potential for modular or holistic use in different contexts. As a result, the use of CBP contributes to an up-to-date discussion with its outputs based on empirical studies at a variety of scales.

**Keywords:** Design education, Public space, Architectural-ICT tools, Cartography-based platform, Collective Intelligence

## 1. INTRODUCTION

The August 2020 COVID-19 report states that more than 190 countries and 1.2 billion students (Figure 1) are taking a break from face-to-face education due to the pandemic (UNESCO, 2020). There are many theoretical and practical studies with interactive, distance, and online learning environments, approaches, and methods in the associated literature. The research examined the Distance Education Journal published its first issue in 1980, the EDUCAUSE Horizon reports, and the Distance Design Education blog based in the UK. Several topics should be highlighted here, including collaborative learning and interaction styles, interactive learning and mass online courses, and pandemic-era online education and assessment methods (2005-2021) [1-4]. On the other hand, in the Turkish Online Journal of Distance Education, the first issue of which was published in 2021, discussions are sprouting in the pandemic environment. In addition to its constraints and difficulties, the pandemic crisis has a significant impact on paradigm shifts (O'Reilly, 2020), pivot points for widespread transformations (Salmon, 2020), or a turning point for design studios (Brown, 2020) particularly in the field of education [5]. As Thomas L. Friedman points out in his article 'Come the Revolution' in the NY Times (2012), revolutionary breakthroughs happen when the possible meets the desperately necessary. The online learning ecosystem transforming architecture and design education offers an opportunity to question the impossible patterns of the recent past.

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Figure 1. Face-to-face education status at the beginning of the epidemic (a); total quarantine time (b) (UNESCO, 2022)

Nigel Cross, who played a role in the development of the first distance education courses in design (Open University), is significant for the theoretical framework of the research, with his discussions on design methods and the scientification of design from the 1960s to the present [6]. Recent trends that promote debate about methods, online ecosystem actors and their outputs have supported the significance of the factors that the study measures and is related to, especially in the last two years. A study includes the delivery, interaction, and assessment (DIA) model [8] that defines the main challenges of online teaching. It is seen that pedagogical clusters and components are represented by a network of intertwined diagrammatic relationships, and the basic factors determined in the DIA model are represented in a central spiral relationship. Six pedagogical clusters analyze the potential contributions of a sensitive and resilient architectural education based on social constructivism theory; empathy, activism, inclusivity, collaboration, change, digital learning, and teaching modes are emphasized [7]. Therefore, besides the focused factors and their effects on the learning ecosystem, the (dialectical) relations between these components are also crucial. This allows for a separate and contextual analysis of each factor's effects on the linked statement or statements. The factors focused on in the study should be discussed along with their positive and negative effects on this axis.

Field trips, teamwork, jury and group interactions in architecture, particularly design studios, are included in the research's consideration of online and hybrid learning environments. The problem area is supported by preliminary pilot studies conducted as well as global-scale reports and academic research. For example, a series of experimental studies and surveys conducted in 3 groups ( $n = 36$ ) in the 2020 Fall semester Introduction to Architectural Design (IAD) studio provide relevant statistics in this context. As one of the factors measured here, the level of interaction factor (LIF) shows the importance of developing strategies against pandemic conditions. Contrary to a high value of 6.36 (m) in-group LIF on the 7-point Likert scale, LIF has a low value of 3.75 with other IAD groups and 2.11 with upper-period AD groups (Figure 9). Therefore, the strategies and methods developed at this crucial time when educators, students, and the institutional infrastructure are rapidly adapting can be evaluated from this perspective. In particular, to increase the efficiency and resilience of the online process, the integration of DIA-like models, their experimental application, and the measurement of their effects are required. The ICT tools and methods used in this context vary depending on the requirements of the online process. Computer-aided design tools and computational design thinking developed within architectural ICT provide a wide literature in this context. Sarıyıldız and Veer identify the role of ICT in AD education related to different purposes like (1) information processing tool, (2) communication tool, (3) visualization tool, (4) knowledge integration tool, (5) decision support tool, and (6) design tool [9].

Beyond geographic and urban studies, collective cartography is utilized as one of these methodologies with digital and physical interfaces in participatory and collaborative design processes [10] and design

education [11,12]. The use of a cartography-based platform (CBP) is investigated in this study to determine its effects, potential, and limitations on three crucial factors: interaction, idea generation, and evaluation. It is anticipated that the research will contribute to the existing hybrid learning ecosystem both academically and practically. The research designed in this direction can be structured into a triple structure:

- I. In the methodology section, the integration of the use of the cartography-based platform into the online ecosystem, descriptive information about the implementation process, and the tools used are included.
- II. The findings obtained following the research methodology are presented within the framework of the (sub) factors that are intended to be measured. In addition to the targeted variables, the effects of the interface customizations are statistically examined by comparing the results of experimental applications conducted in consecutive years
- III. Finally, the results of the study are evaluated on the axis of experimental practice and other related preliminary or international studies. In addition, the potential and limitations of the ongoing work process are discussed in the future projection.

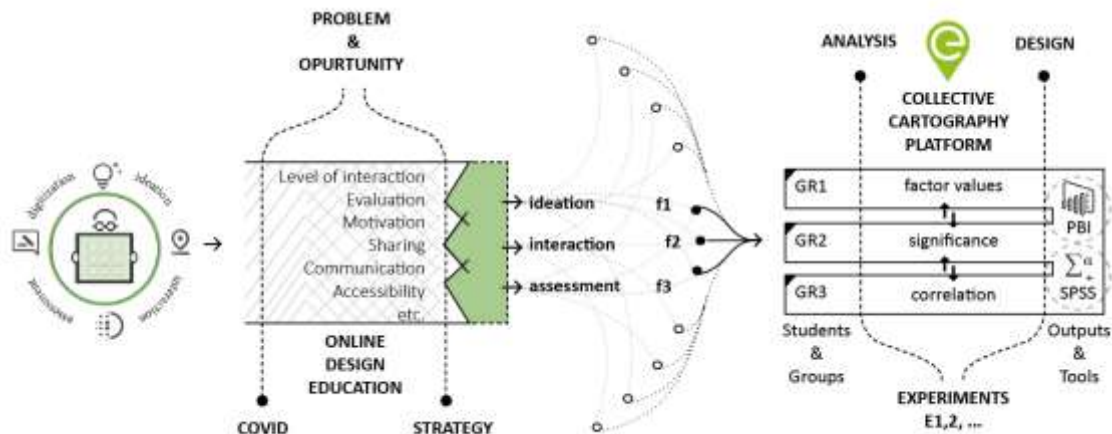
## **2. METHODOLOGY**

By implementing CBP, the research methodology is developed within the context of evaluating the outcomes and addressing the primary challenges encountered during the required and unexpected shift to online education. The CBP developed within this scope is modularly integrated into the online ecosystem. Therefore, the platform has the opportunity to be used periodically at different stages during the course process.

The first experimental study was carried out as a part of the online Introductory Computer Sciences (ICS) course at Yıldız Technical University, Department of Architecture, in the spring term of 2021. For CBP, the open source Emaptic application connected to the Geographic Information System-based Leaflet library is used. Two (mid-term and end-term) stages of the process in which students participate are comprised of a total of 220 to 230 students (5% reduction in attendance during the semester) from three groups. It focuses on the public spaces in the city where students live and where they take the course online. Each student is expected to analyze the public space and develop a solution-oriented/data-driven/parametric design proposal. In groups of two, the initial analytical phase is completed, and each student completes their design concepts. Students apply the digital design techniques and tools they have acquired in the course during this process. In 2022, the application was repeated within the scope of the same course with the privatization of the interface in line with the findings of the previous year. A total of 170-180 students from three groups participated. Apart from the interface and the participants, the study areas (scale) also differ between the two applications. While the public spaces determined by each student in the different cities they were in during the quarantine period covered a very large area for experiment 1 (E1), this scale was limited to the city of Istanbul, where the university is located, for experiment 2 (E2) repeated in hybrid education conditions.

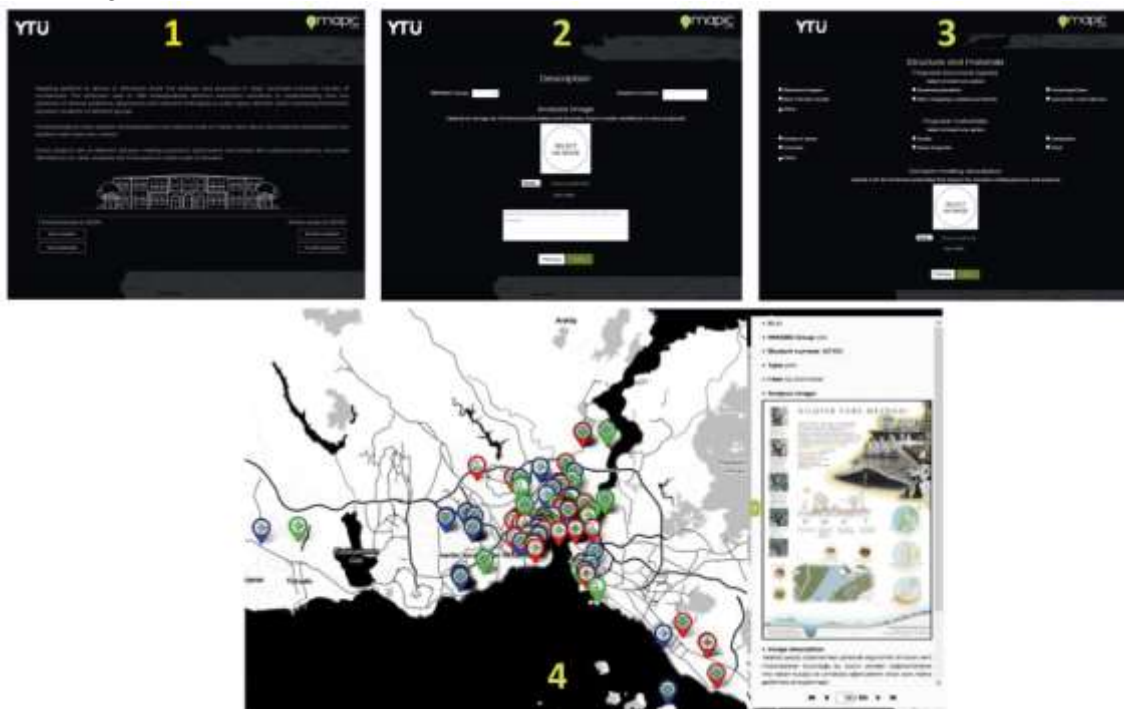
By taking an approach similar to the DIA model, three main factors were determined in the preliminary studies. These can be listed as the lack of sharing, discussion, and idea generation environment (f1: ideation), limited interaction level between and within groups (f2: interaction), and online assessment problem (f3: assessment). As a result, there are CBP strategies centered on interaction, production, and evaluation, as well as strategies that are mass generated (and consumed) by students, to fill the void left by the pandemic crisis' constraints and uncertainty (Figure 2). In addition to examining the implementation process and outputs of the strategy developed to provide an interactive, sensitive, productive, efficient, and inclusive design process that is open access for all, the student experiences and critiques are utilized to analyze the strategies produced and their effects. In this direction, the effects

of the platform on group interaction, idea generation, and evaluation are measured with student questionnaires. In order to scale these three determined factors and to create a reference for similar studies, the necessary expressions regarding the interface, strategies, and experiences are also included in the survey. The feedback obtained in line with these statements forms the basis of the improvements in the interface repeated as E2 after E1.



**Figure 2.** The strategy designed within the research methodology, the platform used, and the implementation phases (Author)

Students access the platform via the given link. First, the home page with the previous years and the option to upload active analyses and projects serves as a guide. Students have the choice of browsing through projects in the uploaded or past archives without actively uploading. Then, the student uploads her/his analysis or design proposal into the system within the framework of the structure created on the platform (Figure 3).



**Figure 3.** CBP (1) home page, (2) analysis, (3) design (4) data input and display of data uploaded to the platform (Author)

As part of the analysis phase, students upload the basic approaches covering three topics: the category of the study area, the type of problem(s) with the field, and the design proposal. Diagrams and drawings are used to assist with the studies carried out here. Between the analysis and design phases, the platform is accessible to all groups for approximately three months. Students and coordinators can examine the analysis data in the system, and it can be updated by uploading content in the specified process. Unlike E1, in which the platform is used for the first time, students in E2 can access their data entries from the previous year on the platform.

The second stage is aimed at constructing the evolution of design approaches in a parametric structure and questioning them together with other suggestions. This framework first encourages students to uncover the causalities regarding the decision mechanisms in their projects, and then to examine the problem-intervention or potential-intervention conjugates in different contexts in the platform contents. Therefore, beyond the digital tools used in design processes, students' problem-solving skills shape the structure of the platform in the context of parametric/computational design thinking. The content of the platform includes the student's design decisions, environmental (contextual) and design program parameters, structure type, and material choices. All content is additionally supported by animated visual context and approach steps.

Aside from parametrization, determining the concept for the intervention strategy is critical, especially since the project fields are public. The strategies take into account the PPS (Project for Public Space) public space design parameters and the triple (undo, redo, do not) approach of the n'UNDO organization. The contributions of the parametrically articulated design concepts (design phase) and the context-specific methodology specified in the analysis phase are questioned by self-evaluations. SPSS uses descriptive statistics and one-way ANOVA analysis for analyzing the scales and expressions in the survey conducted after the application. The independent T-test is used for the correlation between E1 and E2. Furthermore, the Power BI tool is used for online self-assessment analysis and data visualization.

While the Emagic resource for CBP was used in the beta version for the first phase applications (E1), some customizations were made in the interface and content in cooperation with the Coruña University Cartographic Engineering Laboratory for E2. Solutions have been developed in the redesigned interface to improve the following:

1. Demanding access to content from earlier experiments
2. Requirement for a wide range of data entry forms for the options involving repetitive questions, multiple selections, etc.
3. Demanding the adjustment of font type, size, descriptions, and background colors
4. Requirement of filtering, icon, and display settings to improve data readability

To maximize efficiency in the continuity of the work, the adjustments in the E2 interface have been decided upon based on E1 experiences, and the mock-up has been designed and developed on Adobe XD.

### **3. RESULTS**

The CBP application process and the statistical data are the two sections of the findings that can be conveyed in accordance with the research methodology. The systematic presentation of the process, results, and feedback assists in ensuring that the conclusion section's evaluations are conducted in a way that is pertinent and consistent.

### 3.1. Implementation Processes and Outputs

Experimental application processes and outputs provide direct and indirect data for the factors examined within the scope of the research. 85% of the 3 groups of students participating in E1 are second-year architecture students, and 59% of these students are female. However, there is no significant difference in the measured factors related to these categorical variables. When the distribution of the data on collective cartography is examined after the first analysis stage, the students attending the online course are distributed across 47 urban contexts. Istanbul (40%), Izmir (7%), Konya (5%) and Ankara (3%), are the cities with the highest intensity. During the term, it was reported that students changed their places due to pandemic conditions. In the general distribution of the platform, it is clear that there are cities with distinctive characteristics from various climates and geographies. This intensity can be analyzed through the various expressions and filtering layers (Figure 4).

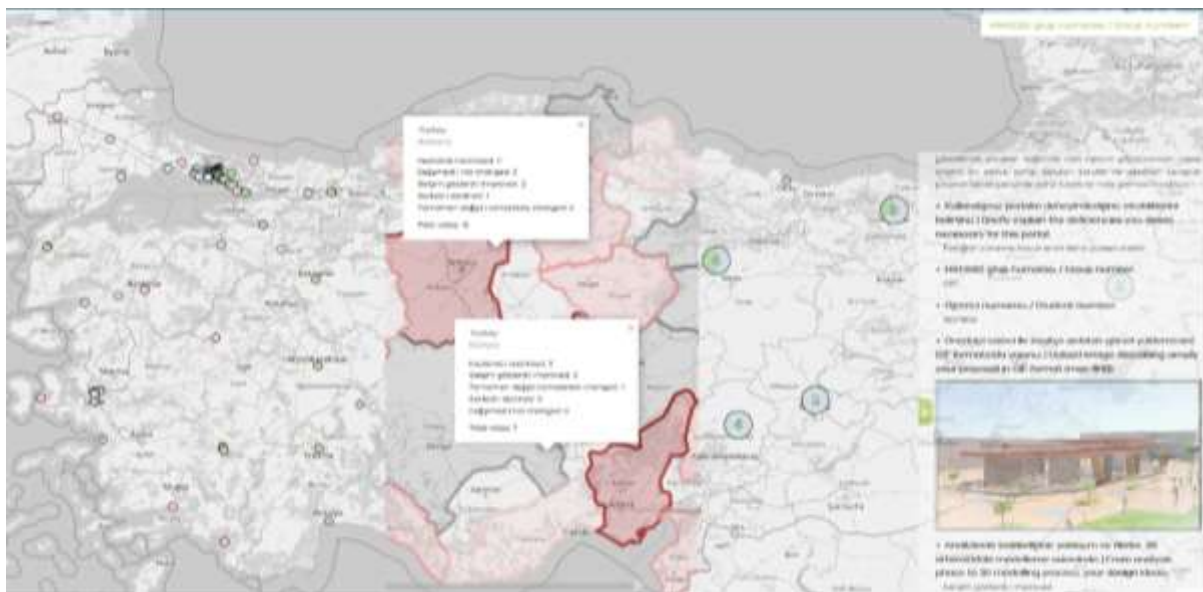


Figure 4. Single, cluster, general, and project display layers within the platform (Author)

Some statistics stand out in the use of two-stage CBP. The data uploaded by the students in various categories supports the geographical diversity covering 47 cities. (1) field analysis and (2) problem type are detailed in the first stage, and (3) the design proposal is detailed in the second stage. For field analysis, it is categorized into four categories as square (54%), street (20%), park, recreation and coastal promenade (17%) and other categories (9%) including market area, stops, idle or waste areas. There are five categories of social (61%), built (9%), natural (6%), historical environment (3%) and other (multiple hybrid situations, 21%) for the prominent problem type related to the area. Adding (47%), transforming (21%), protecting (4%), removing (3%) and other (25%) forms of intervention were adopted as solutions. Therefore, (1) square, (2) social and (3) add categories constitute the majority of the general categorical distribution for E1 (Figure 5).

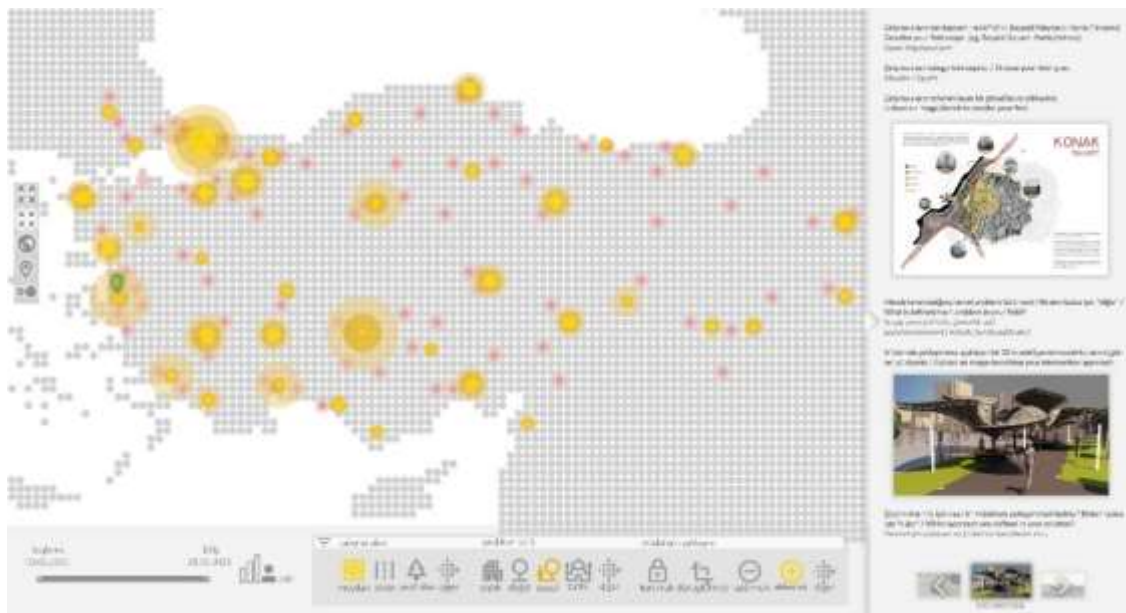


Figure 5: Display of filtered data distribution on collective cartography (Author)

Animated images (GIFs) on the platform are used to support concept design concepts, use scenarios, and parameter-based evaluations during the E1 proposal stage. Evaluations were conducted by the PPS organization's systematized list of the key factors influencing the quality of public space. Thus, the students evaluated the suggested individual approaches and design concepts based on the following criteria: sociability, uses-activities, access-linkages and comfort-image concerning the issues discovered during the analysis phase. The general distribution of the groups for the criteria based on a 7-point scale is as follows (Figure 6).

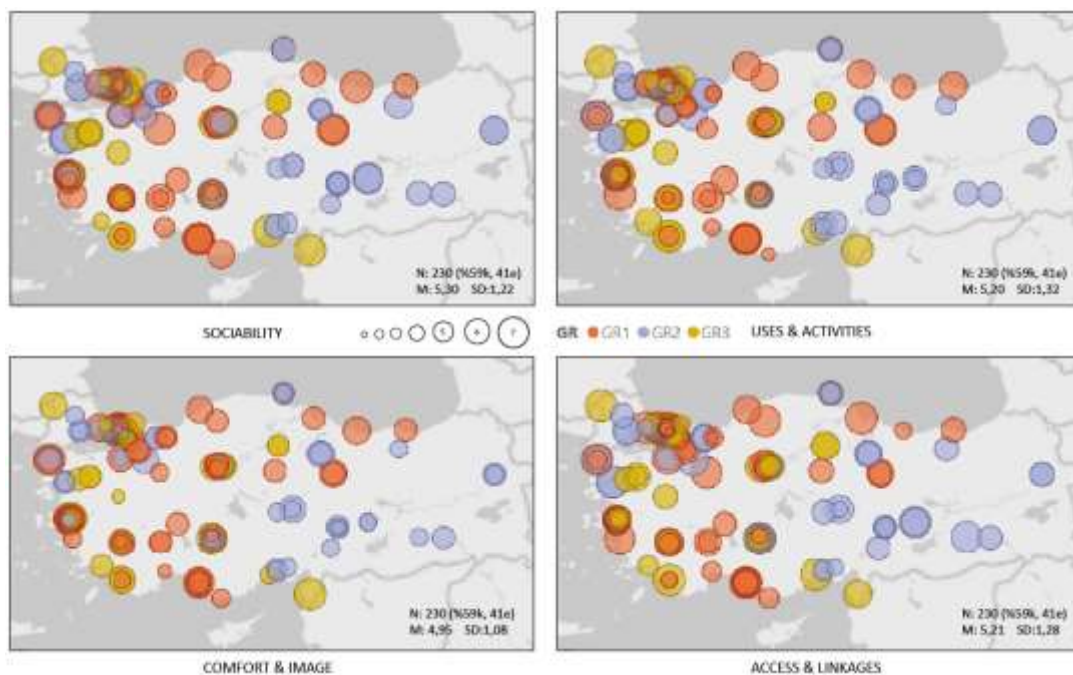
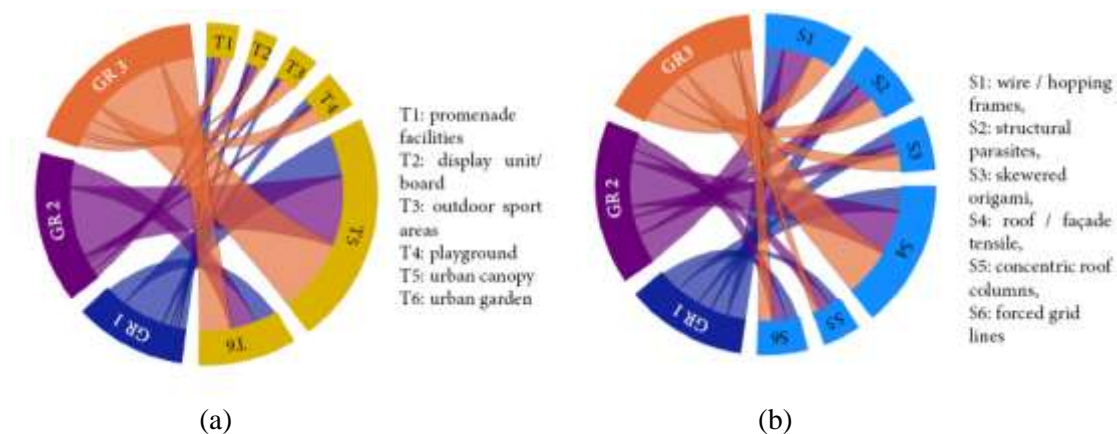


Figure 6. Criteria evaluations by groups (created in Power BI by author)

The process, which includes the E1 analysis and proposal stages, was completed in 2021 in the online learning environment. To support the results gained in this study and to address any shortcomings, the experiment was redone with interface modifications. Both examinations were carried out within the scope of the same course, as stated in the methodology section, and the effects of the modifications were observed.

The project areas for the E2 analysis phase, which was carried out in 2022, are concentrated around the Historic Peninsula, Galata, Beşiktaş, Üsküdar, and Kadıköy. The general distribution is spread over a wide area from Bakırköy to Adalar and Tuzla. For area analysis, it is divided into four categories: square (68%), street (4%), park, recreation and coastal promenade (9%) and other categories (19%), including market area, stops, idle or waste areas. The prominent and repetitive problem types related to the field in E1 were categorized as physical, social, and environmental for E2. Poor accessibility (6%), disused spaces (20%), heritage (4%), lack of inclusion (8%), limited use (19), uncomfortable (16%), microclimate (4%), greenness (18%) and place attachment (5%), are the sub-categories listed here, with the ratios indicated in the area study.

With the knowledge and insights from the E1 proposal stage, a content framework with more detailed and comparable categories was developed for the E2 proposal stage. Apart from the animated visual that illustrates the design concept, a detailed analysis is provided in the constructed format: T-proposal types (urban canopy, outdoor sports areas, urban garden, display unit/board, playground, promenade facilities, etc.), C-contextual parameters (view and topography, cultural, existing buildings, walls and borders, orientations, climate, circulation, etc.), D-design parameters (form production, functional program, positioning, scaling, material selection, structural type, etc.), S-structural types (skewered origami, structural parasites, forced grid lines, roof/façade tensile, wire /hopping frames, concentric roof columns, etc.), and M-materials (timber, textile, composite, concrete, stone, steel, etc.). The general distribution under categories can be examined by their intergroup or categorical relations (Figure 7).



**Figure 7.** Proposal types (a) and structural types (b) in the E2 content distribution by groups (Author)

Students are able to query or filter about their subject or other projects working in the immediate region through the platform. The platform includes concept design ideas supported by animated visuals (GIF) and explanations related to parameters (Figure 8). A variety of detection and design proposals for public spaces attract attention, particularly for E2, with the possibility of archiving the previous year. With the filtering option, results for any parameter can be displayed in the analysis and proposal database. Thus, they can examine other projects and critiques that relate to their problem area and approach.



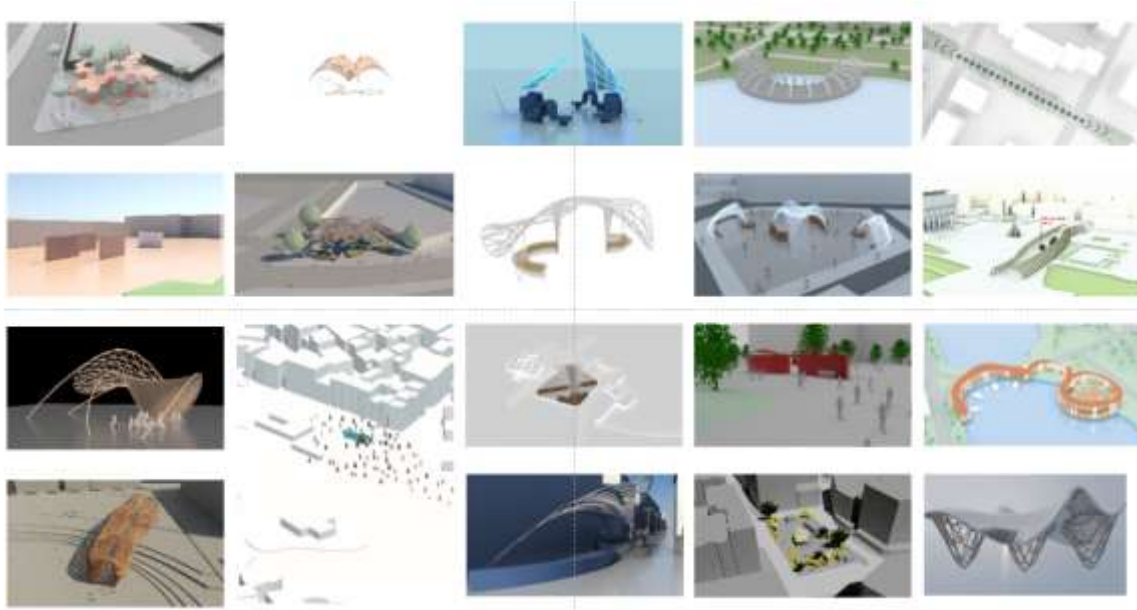


Figure 8. GIF composition showing design suggestions filtered in E2 interface (Author)

Experiment processes (E1-E2) and outputs are crucial in observing CBP effects and detecting deficiencies. This process takes into account the instructors' and course assistants' criticisms and comments. On the other hand, the effects of factors are intended to be measured more clearly by conducting surveys of the participants.

### 3.2. Statistical Findings Based on Participant Experiences

The preliminary survey conducted during the development of the CBP and detailed in the introduction points out the problem. The level of interaction factor (LIF) can be highlighted in this context as it is related to the basic function of CBP (Figure 9).

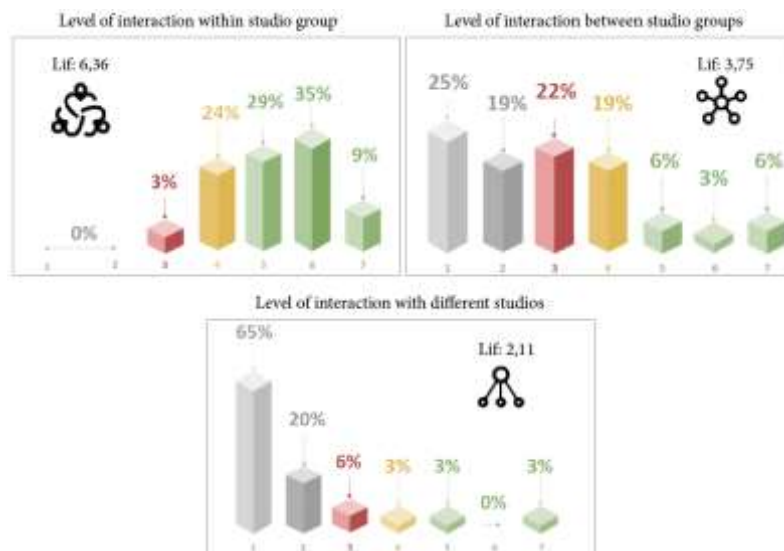


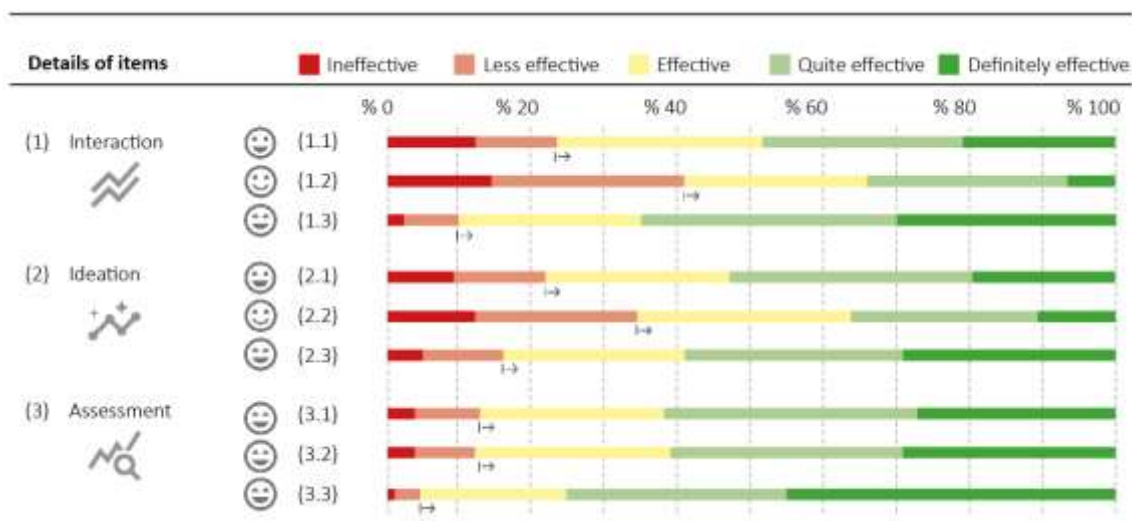
Figure 9. Different dimensions of interaction level obtained from survey results (Author)

The survey findings were imported into the SPSS environment after application and evaluation. This was done so that the effects of the three components and different expressions of platform utilization could be analyzed. The mean, standard deviation, and positive level for findings based on a 5-point Likert scale are shown in Table 1. In addition, the Tukey test is used in dataset analysis that meets the variance homogeneity condition. Differences are observed in the expressions of idea generation, sharing, and evaluation among the groups. There is no significant difference in other expressions (Table 1).

**Table 1.** Analysis of survey data by the author

Factors	Items	Participants (N = 230)		Level of positivity	Anova Tukey HSD Test			
		M	SD		GR1	GR2	GR3	Sig.
(1) Interaction	(1) Within / between groups	3,4	1,2	% 72,8	,040	-	,040	<b>,048</b>
	(2) Level of participation	2,9	1,0	% 56,8	-	-	-	-
	(3) Form of interaction	3,8	0,9	% 89,7	-	-	-	-
				<b>% 73,1</b>				
(2) Ideation	(1) Sharing	3,4	1,2	% 76,9	-	,020	,020	<b>,025</b>
	(2) Ideation	3,0	1,2	% 65,1	-	-	-	-
	(3) Discussion	3,6	1,1	% 82,6	-	-	-	-
				<b>% 74,9</b>				
(3) Assessment	(1) Assessment	3,7	1,1	% 86,7	-	-	-	-
	(2) Transparency	3,7	1,1	% 87,2	-	-	-	-
	(3) Open access	4,1	0,9	% 93,8	-	,035	,035	<b>,024</b>
				<b>% 89,2</b>				
<b>Mean</b>		<b>3,5</b>		<b>% 79,1</b>				

Evaluations that measure the expressions included in the factors with a cut-off point of 3 or higher are regarded as satisfactory. By thoroughly analyzing each statement to identify the significant distinctions and the relationships between them, it is possible to analyze the positivity levels of each claim in this approach. Among the findings, 'open access' (93.8%) had the highest level of positivity and 'class participation' (56.8%) had the lowest (Figure 10).



**Figure 10.** Detailed analysis of the level of positivity in the survey results (Author)

Regarding the E1 data entry and display interface experience, there are quantified expressions. Here, open-ended responses to the initial survey (n:230) were compiled under categorized headings such as "preview" and "location pinning." Then, using results from a second survey, statistical correlations between these categories were discovered. The prominent categories are respectively uploaded file size and format (71%), data display/review on the platform (68%), location pinning (64%), interface experience (64%), data updating and editing (61%), and viewing platform on mobile analysis (51%), graphical icon-like representations (45%), data loss during internet outages (29%), comments and criticism (29%), archive feature (26%), etc. as a distribution. According to the research, customization is a contributing factor in several of the major interface problems. These evaluations reveal the effects of the interface alteration between E1 and E2 (Figure 11). Values given as a percentage refer to participants' reports of the same issue. The approach points in the yellow region are intensifying toward 0, indicating that E2 customization has reduced the shortcomings.

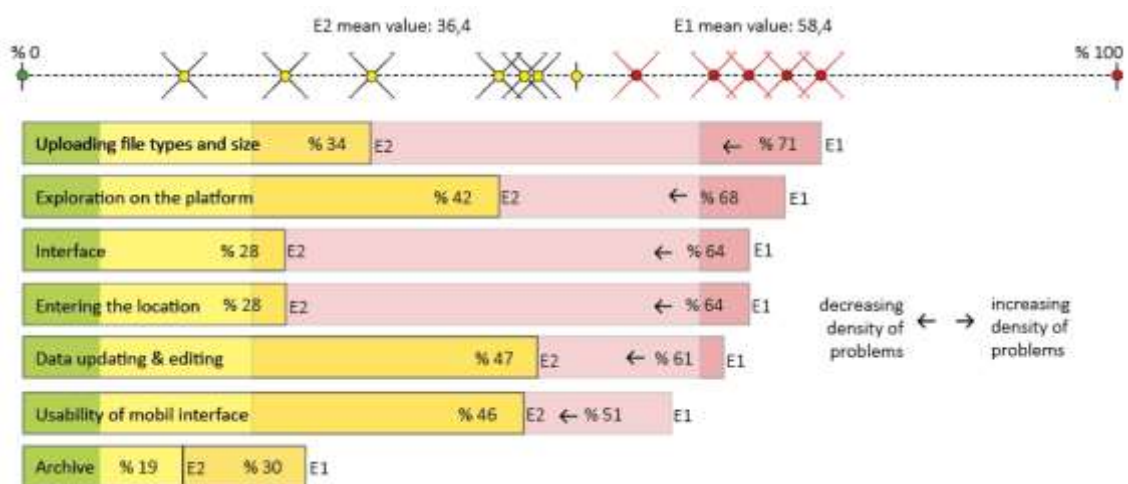


Figure 11. Graph of problems/deficiencies related to the interface usage of the platform between E1-E2

All measured values in the survey results repeated after the second experiment (E2) show an increase. The levels of idea generation and class attendance had the biggest increases. These value increases can be linked to improving (customizing) the interface and including the platform's archive from the previous year. (Table 2). With an independent sampling-based T-test, comprehensive inter-statement findings for E1–E2 can be explored. This illustrates how all of the expressions varied significantly.

Table 2. Change between proposal stage first and second application factors (Author).

	Factors	Interaction			Ideation			Assessment			M
		(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
E1:	items	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
	M	3,4	2,9	3,8	3,4	3,0	3,6	3,7	3,7	4,1	
	avg.	3,4			3,3			3,8			3,5
E2:	items	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
	M	3,8	3,7	4,2	4,3	4,1	4,1	4,1	4,2	4,4	
	avg.	3,9			4,2			4,2			4,1
	t-test sig.	,001	,000	,001	,000	,000	,000	,000	,000	,002	

#### **4. CONCLUSION**

Findings from the process, output, and participant experiences demonstrate the CBP strategy's potential to transform crises into opportunities while being straightforward and practical to execute. The findings regarding the three main factors examined in the context of E1 can be evaluated respectively:

- The interaction factor findings confirm the positive effect for all three groups (GR1,2,3). In contrast to other expressions, the low degree of positivity for class participation would be attributed to a variety of factors. These factors include challenges with adaptability brought on by pandemic conditions. The key element in this situation can also be studied by looking at the mass structure of the student population for each group. CBP thus appears not to be sufficient to promote full participation in the course, even though it catalyzes a variety of causes and expressions. A comparison of active experiments in this area would provide a clearer conclusion.
- The interaction factor for idea generation was found to be close to the average level of positivity (74.9%). In contrast to other expressions, group differences in 'sharing' can be explained by factors like student numbers (GR1,2-TR; GR3-EN students are fewer than GR1) or the course's language. However, the broad terms do not significantly differ among the groups. The benefit of using CBP for idea development can therefore be underlined as a point of agreement for all groups.
- The evaluation component has the highest level of positivity (89.2%) when compared to the other factors. Open access has the highest value due to its widespread acceptance. It is anticipated that this potential will increase as the archive becomes a more diversified resource, depending on how long CBP usage continues. Scoring the design proposal according to the criteria for the following stage of the platform, which is integrated into the course as a modular, provides the opportunity to support self-evaluation. The CBP's development of the rubric function is one of its objectives since the discipline of architecture benefits from the objective assessment of project proposals and the transparency principle. Mockup studies continue to demonstrate how an analytical system can be created and assessed using the platform's evaluation feature. This is a draft idea for developing the framework of a system that can adapt to diverse studio objectives. For instance, two key evaluation criteria of the course are the design proposals created for the public space in the experiments conducted under the ICS (2021, 2022) and the use of computational design tools in this process. A wide range of sub-parameters can be used to structure these criteria. At this point, the platform can be used to support the legibility and transparency of the uploaded content and evaluation criteria (Figure 12). This parametric assessment method is expected to enable straightforward searching, filtering, and reviewing of the content as the platform archive expands. Figure 12 shows the graphical maps of the projects in Istanbul based on eight criteria. The priority factors selected in the filtering section either emphasize the associated projects or, in a time-saving manner, push many projects into the background.

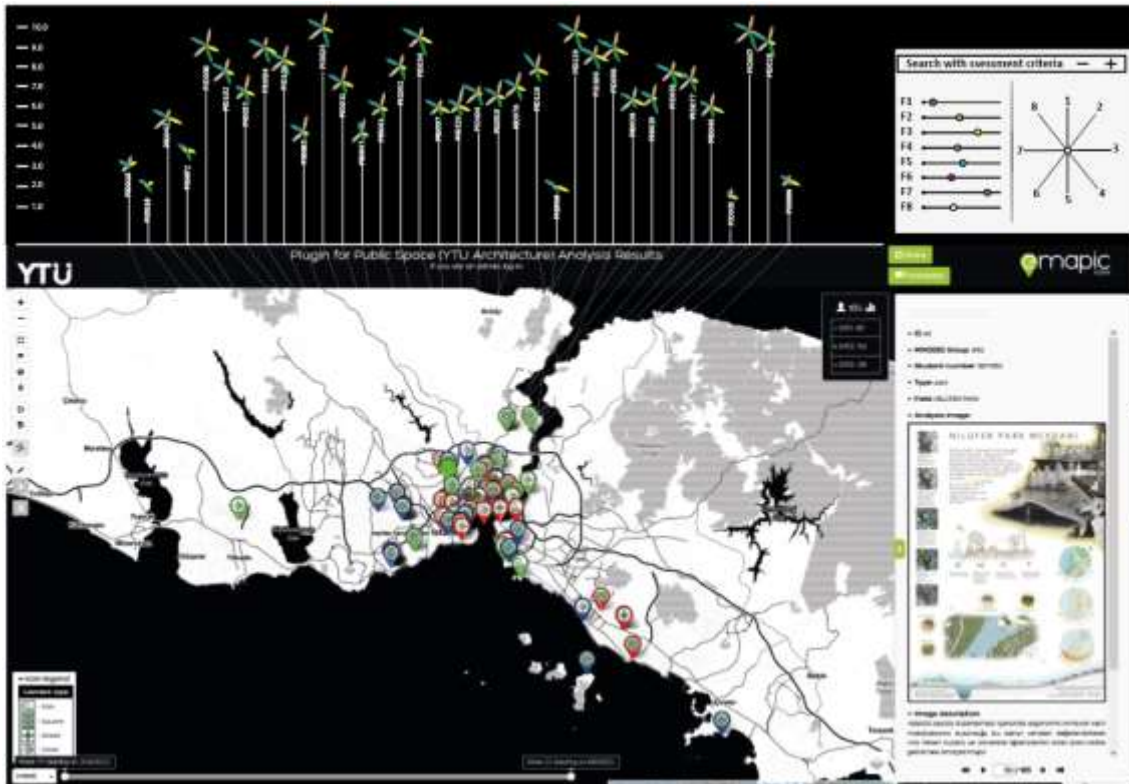


Figure 12. Mockup of the evaluation function of the platform

In the context of the same course, it is possible to review experiment findings that were abandoned as E1 and E2 along with various scale/context, environment, archive, and interface customizations:

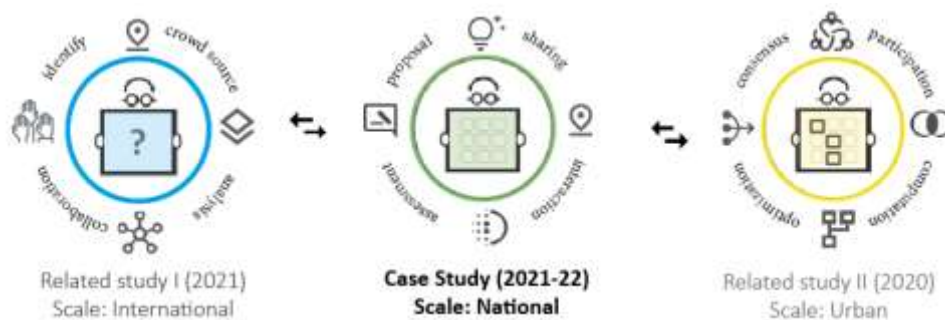
- Despite the fact that E1 and E2 were tested on two distinct scales, "Square" is the most chosen study area for both E1 (56%) which includes cities across Turkey and E2 (68%) which is limited to Istanbul. In terms of the square, it can be seen that E1 manages social dimensions more effectively than E2, which has disused spaces (20%), limited use (19%), and greenness (18%) in the first three. Approach, function, structure, material, and design factors all show both similarities and contrasts. As a result, the study's repeated in many scales and situations both demonstrates the range of its CBP outcomes, or richness, and promotes the development of novel methodologies.
- A few assertions after E2 also merit notice, in addition to the overall statistical findings: The intra-group and inter-group CBP effects are similar (m: 3.87–3.78) in the expressions that comprise the interaction factor, with the intra-group interaction effect being greater. The CBP needs in the face-to-face and online learning environments are similar (m: 4.14–3.94) and are higher in the online environment according to the expressions included in the Ideation factor. CBP can therefore be beneficial in hybrid and face-to-face design studios, especially in lectures that are attended by larger numbers, although it was created in a pandemic environment.
- Providing more definition of the course process through open-ended questions answered concerning the advantages and potential of the platform used, being informative about other projects and approaches, enhancing in-class and intergroup interaction, providing a transparent process for evaluation, and applying it over an extended period. There are many positive

statements, such as the potential to generate a resource. Although these evaluations for E1 and E2 are similar, the archiving potential and ability to view other period projects (82%, there is agreement in this statement) and support for idea generation (70%), stand out.

- Interface improvements are evaluated separately and compared across E1-E2. With the beta version used in E1, the platform, which is widely used for survey studies, has limitations in research, especially related to the interface. In this direction, it is predicted that improvements such as the ability of the executive to organize and customize the layers, the ability of the students to make corrections and evaluations, the variety of questions and formats, the preview and filtering options, and the search and analysis in the archive will make the process more efficient. Therefore, it is imperative to observe the impact of interface customization on the identified factors of CBP usage. Here, the revised interface has a significant positive effect on both the user experience (Figure 11) and the factors (Table 1). These customizations and tests will continue in the later stages of the study in line with E2 feedback.

The use of the results of the study (online) in education can be evaluated in similar studies in the context of architectural ICT tools and the collective cartography method. This multi-perspective approach is crucial to discuss the pervasive impact, unique impact, and benefits of the study:

- The research findings, ranging from an online design studio for first-year students in Australia [13] to the limitations of field trips and field study in pandemic conditions for architecture students in Slovakia [14], as well as student satisfaction with the original strategy tested by Jordanian universities in its context. It contributes to a common and up-to-date discussion, such as studies conducted in different contexts, to the assessment of the difficulties in online architectural education across Nigeria [15].
- Ongoing research related to the first author's doctoral thesis is being assessed at various levels (international, national, urban, and neighborhood) (Figure 13). With regard to the factors examined here, a goal is to identify the potential of the collective cartography method in terms of collaborative design. This is done through working together and producing in varied educational contexts. Findings from this study provide supporting evidence for the assessment of a range of factors measured in other contexts. For example, CBP, which is used as a tool for environmental awareness and transparent assessment on an international scale, is tested as a collaboration and coordination tool for field studies carried out within the scope of the Architectural Design Introduction studio at a neighborhood scale (Kuzguncuk) and as a collective decision-making tool for another related participative workshop.



**Figure 13.** Development of the study on different scales and factors (Author)

According to one of the related studies, restoration and determination studies within architectural education were examined using a similar method based on the collaborative mapping. An examination of the priorities in the context of rural locations reveals a number of significant features, including offline data entry. Data collection in various layers and forms, or the use of mobile devices, appears to be the main priority for the CBP, which was evaluated for fieldwork as part of the architectural design course.

This study demonstrates that CBP, which is designed and assessed in a variety of contexts and based on certain factors, has significant potential to contribute to the development of online and hybrid architectural education. In addition to assessing the feasibility of its distribution throughout the full period and the depth of its archive, it must also be designed with modular integration. Experimental applications can be used to ascertain and enhance the constraints or shifting priorities identified here.

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## **CONFLICT OF INTEREST**

The authors stated that there are no conflicts of interest regarding the publication of this article.

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