RECIPROCAL RELATIONSHIP OF CONCEPTUALIZATION AND DESIGN PROBLEM DEFINITION

A proposed approach for an architectural design studio

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ABSTRACT: This research paper proposes an approach to be applied in the design studio. The proposed approach highlights the reciprocal relationship between concept articulation and design problem definition in a design method that exposes different design activities related to this relationship. The design method was applied in a design studio of an intermediate level. The study reports the analysis of student designs in terms of the deign method employed. Moreover, a survey was carried out in order to measure the responses of students and instructors regarding the design method and its approach. The main structure of the design method proposed can be described as follows: although the relationship of concept articulation and design-problem definition are reciprocal, the influence of one direction can be distinguished more than of the other direction on different design activities. The research using qualitative and quantitative methodologies analyzes the results and outputs of the theoretical investigations, the practical application in the design studio, and the questionnaire responses through different methodological tools.

KEYWORDS: Conceptual design, design method, architectural design studio

RÉSUMÉ : *Cet article propose une approche qui met en évidence la relation réciproque entre l'articulation du concept et la définition du problème de design selon une méthode qui expose différentes activités de design en lien avec cette relation. La méthode a été appliquée dans un atelier de design de niveau intermédiaire. L'étude fait un compte rendu de l'analyse des designs des méthodes employées par les étudiants. De plus, une étude par questionnaires a été faite pour comparer les réponses des étudiants et des instructeurs quant à la méthode et à l'approche. La structure principale de la méthode de design va comme suit : bien que la relation entre l'articulation du concept et la définition du problème soit réciproque, l'influence de l'une est plus marquée que celle de l'autre sur différentes activités de design. La recherche, utilisant des méthodes qualitatives et quantitatives, analyse les résultats et les produits de la recherche théorique, de l'application pratique en atelier, et des questionnaires à travers différents outils méthodologiques.*

MOTS-CLÉS : *Design conceptuel, méthode de design, atelier de design architectural*

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1. INTRODUCTION

The relationship between articulating the design concepts and defining the design problem has been investigated in pervious research work (Jin and Chusilp 2006; Dorst and Cross 2001; Benami and Jin 2002; Finke, Ward and Smith 1992; Jansson and Smith 1991; and Robbins 1994). The literature introduced a portrait of the simultaneous, reciprocal activities that are preformed in conceptual designing phases, yet there is not enough detailed illustration in response to this relationship along with the design activities performed.

The major outlines extracted from the literature that is related to the subject under investigation, would be summarized as follow:

- Design ideas can be generated from: 1) the architect: her/his creativity (Rowe 1987), subjective interpretation of design-problem context (Akin 1978; Lawson 1980), personal prejudice of design thinking, individual style of design methods (Bazjanac 1974), and way of media use (Cheng 1999; Abdelhameed 2006), and 2) the design problem at hand: its context (Rowe 1987; Akin 1978).
- The solutions of different design problems, conducted by single design thinking, may have similar characteristics (Newell and Simon 1972).
- Invoking some appropriate organizational rules, in order to relate the results from an evaluation of potential solutions to further courses of action, reveals that architects employ streams and references to have the derivation of design ideas or partial solutions (Rowe 1987).

Synthesizing the foregoing points gives the research paper a solid basis to propose an approach to be applied in the architectural education, practically in the design studio. The proposed approach strengthens the investigated reciprocal relationship in a design method, manifesting and exposing the design activities related to it. This exposure privileges architecture students in terms of building up their own design palette of tools and activities where the design method was applied in a design studio of an intermediate level. In other words, the design method emphasizes the investigated relationship and the associated activities performed with it.

2. ARCHITECTURAL DESIGN STUDIO AND ITS DESIGN METHOD

The architectural design studio is designed to explore and build up the investigated relationship through a design project of culture center covering a district level. The total built area is approximately 2000 square meter. Students were given the architectural program with the main components and their areas; there was flexibility for students to adapt minor changes in both components and areas.

At the beginning during defining the design problem at hand, different methods were used in the studio such as conducting discussions and

presenting precedents to explore the design problem. Students were directed to individually articulate a unique concept that reflects each student's interpretation of the design-problem context. During this phase of conceptual designing, students in parallel worked in groups; each group consisted of three students had to search and select at least a site that has potentials to accommodate the design project. The outputs of this phase were: 1) each student constructed a concept of her/his own, and 2) each group submitted a report evaluating the selected site in terms of the environmental factors and the objective interpretation previously discussed.

The next phase of conceptual designing attempted to highlight the main links between concept articulation and design problem definition. Another round of discussions and presentations was to crystallize each student's concept, how it was constructed, what were its links to other activities of problem definition, and what were appropriate rules invoked. After this stage, each student was free to choose a site that is more appropriate to her/his concept and interpretation, even if it is not the one of her/his own group. Few students chose different sites than their groups' sites.

3. DESIGN ACTIVITIES AND THE INVESTIGATED RELATIONSHIP

Although the relationship of concept articulation and design problem definition are reciprocal, the influence of one direction can be distinguished more than of the other direction on different design activities. Concept articulation may impact the design problem definition on the following areas, namely: architectural program (site selection, components, redefining the areas of some components, and add new functions), functional relationships (zoning and bubble diagram), and spatial relationships (initial arrangement of forms, and forming masses and grouping them). Design problem definition, on the other hand, may influence concept articulation through the following areas, namely: constructing the initial ideas of concepts to accommodate the given outlines of design problem definition, and articulating the main concepts to express both the designer's interpretation of the design problem and the given interpretation (in terms of site selection, function, and tentative form creation).

The research paper reports the analysis of students' designs in terms of the deign method employed. The structure of the design method proposed can be described in the following discussion:

3.1. Concept articulation Influence

During concept articulation many appropriate rules are constructed, and as a result, some modifications in elements of both the architectural program and functional relationships are adapted. Concept articulation may impact the design-problem definition on the following areas, namely:

3.1.1. Architectural Program

Students were required to keep their modifications as minimum as possible, in order to maintain the size and complexity of the design project. The appropriate rules were generated from the subjective vision of each student which was behind her/his main concept and subjective interpretation. However, there was flexibility to change the architectural program in terms of its elements, namely:

- Site Selection: Few students chose to change their groups' sites. In one case, the concept-articulation process was related to modern art while the site had a historical style generated from a nearby old fort. The student in this case preferred another site more appropriate to the concept adapted.
- Components: All students added one or two components. In one case, a student adapted a concept of the Earth-protection awareness for the culture center, therefore a gallery and its service components were added to the design project. In another case, concept articulation process was directed to strengthen the family ties of district inhabitants; two components related to this concept were added to accommodate some family activities in the culture center.
- Redefining the Areas of Some Components: Some students decided to increase areas of some components or a whole zone in few cases. In one case, a student chose to increase the zone of public lectures and classes as the concept-articulation process was directed to increase the culture background. In another case, a student increased the library area given in the architectural program, to have a more area for children libraries of different age classifications.
- Add New Functions: Few students added totally new functions to their design projects. The most prominent case was to create an open area linking between the design project of historical style and a monumental fort existed near the site, in order to have an open theatre of multiple functions.

3.1.2. Functional Relationships

Students had the liberty to build up the functional relationships to reflect their concepts and accommodate their interpretations. This liberty affects the activities of design-problem definition in terms of:

- Bubble Diagram: Relationships of some components are highlighted in certain design projects while they did not have the same strength in other design projects. The motivation behind these evidences was the concept-articulation processes.
- Zoning: It was evident that zones are not treated with the same importance in different designs based on the impact of concept articulation, where some particular zones are brought into the focus of some designs.

3.1.3. Spatial Relationships

The effects of the previous area, functional relationships, extend further to appear in the organizational rules that govern spatial relationships of forms and masses. Students were directed to build up their functional relationships to be visualized in three dimensions, and to reflect them in the two factors of spatial relationships, namely: initial arrangement of forms, and forming masses. All students' design cases reflected this area and its factors.

3.2. Design-problem definition Influence

The definition of design problem not only expresses but also originates from both the designer's interpretation and the given interpretation. Design-problem definition may influence concept articulation through the following areas:

3.2.1. Constructing the Main Concept

Some organizational rules generated from the definition of design problem at hand lead to accommodate initial ideas that construct the main concept. This was evident in all students' designs.

3.2.2. Articulating Main Ideas and Constraints

The initial exploration and interpretation of the design problem which form main ideas and constraints, strongly affect the unfolding of the design. Main ideas and constraints may emerge from the immediate context of the design problem, prevailing site circumstances, building purposes (function), and tentative forms. Consequently, the influence of this direction appears in the following:

- Site Circumstances: In the case of the site of historical style, a student chose a modern traditional style as a main idea and constraint for her culture center. Her definition of the design problem generated this traditional notion that impacted the design in different areas and stages.
- Function: Design-project functions lead to specific ideas and constraints that affect conceptual designing. Few students adapted main ideas and constraints emerged from functions and purposes of the building. This was evident in design cases of culture background, historical style, etc.
- Tentative Form Creation: Some ideas that govern the process of tentative form creation originate from the definition of design problem influences. In many designs, students employed certain ideas resulted from the problem-definition process, which are responsible of the composition and proposition of forms. In the case of the Earth protection awareness, the student chose a spherical form to the main building and organized all other components in an orbit shape to express the Earth and orbits.

4. QUESTIONNAIRE

The research paper conducted further investigations and more analysis through a survey in order to measure the responses of students and instructors regarding the design method and its approach. A questionnaire, therefore, was designed to the students who applied the design method in the design studio, and the instructors of design studios in the same university and other universities.

The applicants' number of students attended the design studio was 9, and of instructors from different universities was 24. The methodology of using two independent samples and comparing both results was: to overcome the small number of students participated, and to measure more responses with different backgrounds. Asking other students who did not attend the design studio to fill out the questionnaire was basically eliminated whereas these students would not have the same design background and knowledge which participant students gained during the studio.

The following part of the research paper reports the questionnaire results according to the design-method structure and analyzes both samples of students and instructors:

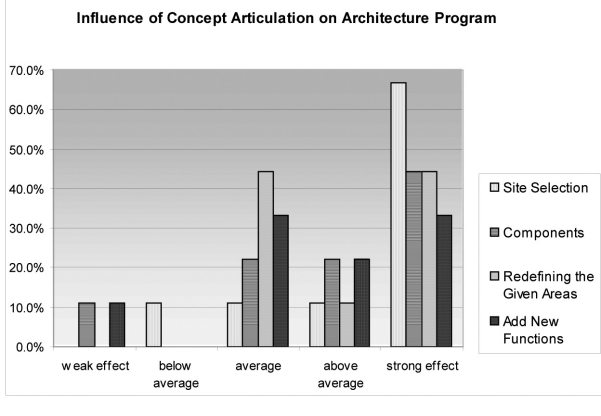
4.1. Concept articulation Influence

Concept articulation may impact the design problem definition on the previously mentioned areas:

4.1.1. Architectural Program

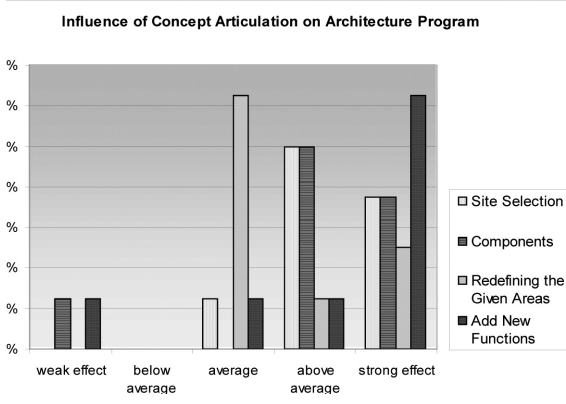
Over 66% of students find the strong effect on architectural program is through the site selection. Over 44% find the strong effect is through both components and redefining the given areas, Figure 1.

FIGURE 1. *STUDENT RESPONSES OF THE CONCEPT INFLUENCE ON ARCHITECTURAL PROGRAM.*



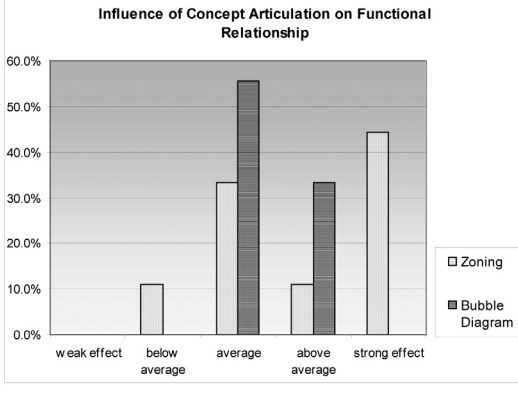
Over 62% of instructors find the strong effect on architectural program is through add new functions. 50% find the above average effect is through both site selection and components, Figure 2.

FIGURE 2. *INSTRUCTOR RESPONSES OF THE CONCEPT INFLUENCE ON ARCHITECTURAL PROGRAM.*



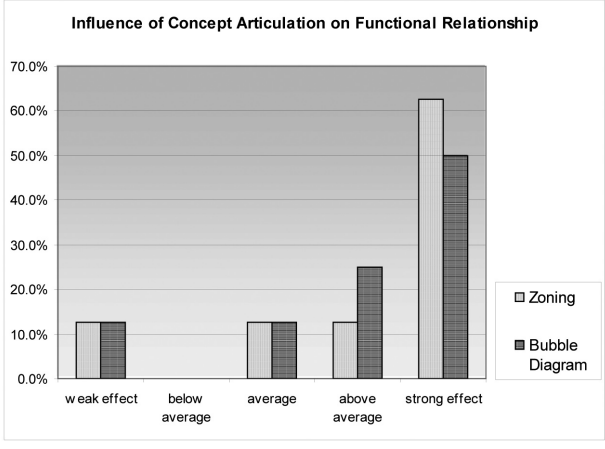
Over 55% of students find the average effect on functional relationships is through bubble diagram. Over 44% find the strong effect is through zoning, Figure 3. No responses of weak effect were recorded.

FIGURE 3. *STUDENT RESPONSES OF THE CONCEPT INFLUENCE ON FUNCTIONAL RELATIONSHIPS.*



Over 62% of instructors find the strong effect on functional relationships is through zoning. 50% find the strong effect is through bubble diagram, Figure 4.

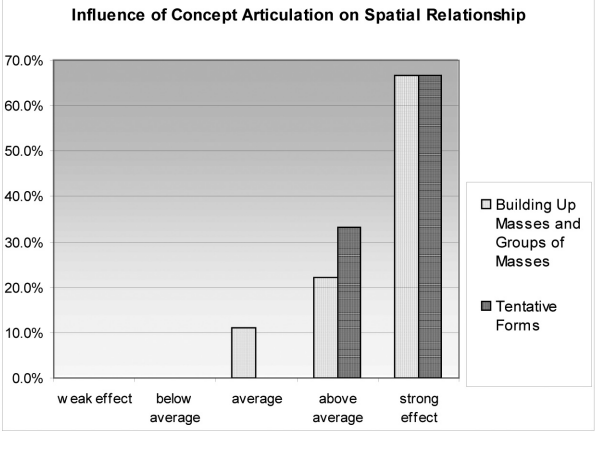
FIGURE 4. *INSTRUCTOR RESPONSES OF THE CONCEPT INFLUENCE ON FUNCTIONAL RELATIONSHIPS.*



4.1.2. Spatial Relationships

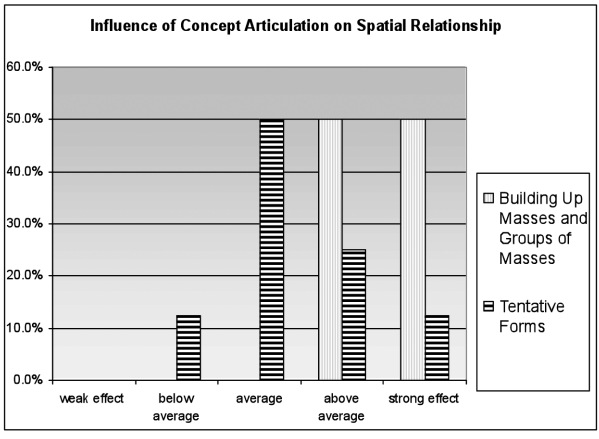
Over 66% of students find the strong effect on spatial relationships is through both building up masses, and tentative forms, Figure 5.

FIGURE 5. *STUDENT RESPONSES OF THE CONCEPT INFLUENCE ON SPATIAL RELATIONSHIPS.*



All instructors find that building up masses and groups of masses has strong and above average effects. 50% find that tentative forms have average effect, Figure 6. No responses of weak effect were recorded.

FIGURE 6. *INSTRUCTOR RESPONSES OF THE CONCEPT INFLUENCE ON SPATIAL RELATIONSHIPS.*



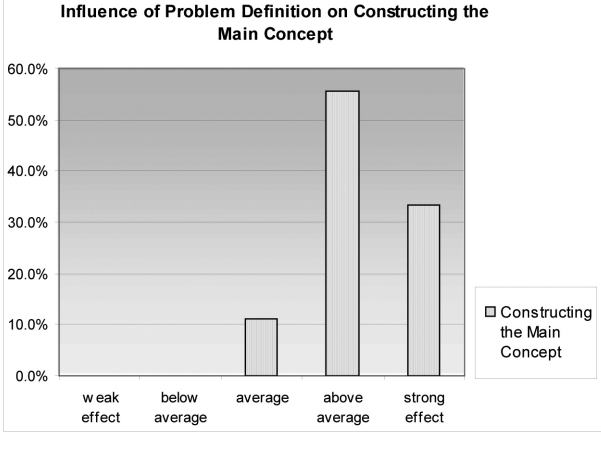
4.2. Design-problem definition Influence

Design-problem definition may influence concept articulation through the previously mentioned areas:

4.2.1. Constructing the Main Concept

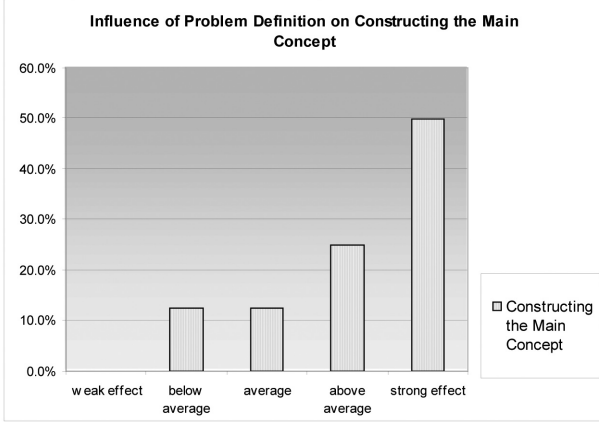
Over 88% of students find that problem definition has strong and above average effects on constructing the main concept, Figure 7. No responses of weak or below average effects were recorded.

FIGURE 7. *STUDENT RESPONSES OF THE PROBLEM DEFINITION INFLUENCE ON CONSTRUCTING THE MAIN CONCEPT.*



75% of instructors find that problem definition has strong and above average effects on constructing the main concept, Figure 8.

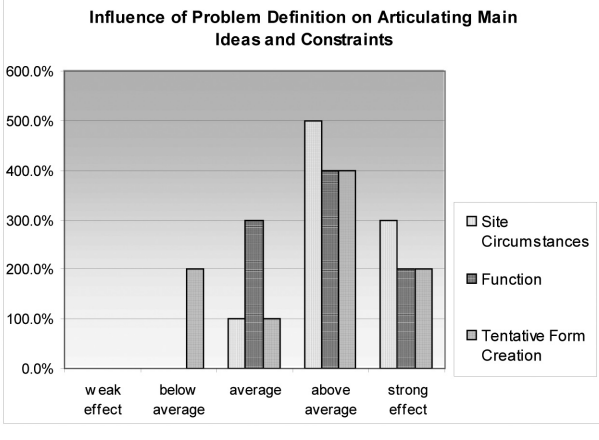
FIGURE 8. *INSTRUCTOR RESPONSES OF THE PROBLEM DEFINITION INFLUENCE ON CONSTRUCTING THE MAIN CONCEPT.*



4.2.2. Articulating Main Ideas and Constraints

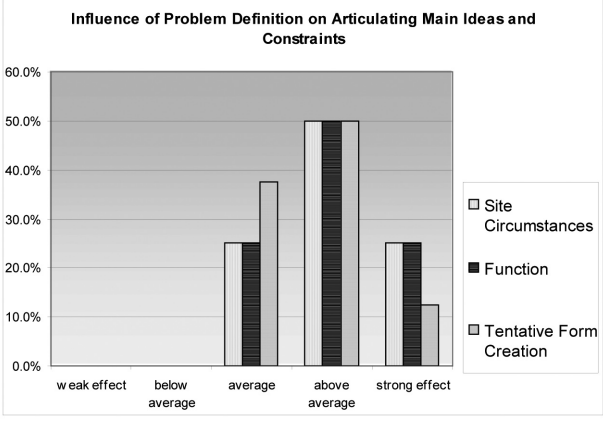
The highest responses of students regarding the impact on articulating main ideas and constraints through site circumstances, function, and tentative form creation, are above average effect, Figure 9. No responses of weak effect were recorded.

FIGURE 9. *STUDENT RESPONSES OF THE PROBLEM DEFINITION INFLUENCE ON ARTICULATING MAIN IDEAS AND CONSTRAINTS.*



50% of instructors find that the effect on articulating main ideas and constraints through site circumstances, function, and tentative form creation, is above average, Figure 10. No responses of weak or below average effects were recorded.

FIGURE 10. *INSTRUCTOR RESPONSES OF THE PROBLEM DEFINITION INFLUENCE ON ARTICULATING MAIN IDEAS AND CONSTRAINTS.*



5. SUMMARY AND DISCUSSION

After presenting a design method, the research conducted a theoretical investigation of design analysis, and a practical investigation of questionnaire responses. The results of both investigations, theoretical and practical, have major similarities whereas the differences are very minor. This result is reflected in the weak and below average effects of all factors and areas of both concept articulation and design problem definition, which are either not recorded at all or recorded with few responses. A similar result also is evident in comparing students' responses to instructors'.

The results of measuring both responses of students and instructors assist in evaluating the effectiveness of factors and areas applied by the design method. These results give positive indicators for what the research paper proposed: these results conform the analysis of student designs which research reported.

In response to the design studio, all students agreed on that explicitly building up concepts and defining the design problem by all students gives them different cases and ways of thinking based on each student's subjective point of view. These forming processes of conceptual designing explicitly performed were beneficial for all students. In each student's case, all other students adapted and adopted her/his point of view while they discussed both concept articulation and problem definition. Furthermore, students said that sharing other students with even just discussions to construct their concepts and in the same

time revealing the influential factors of each design case privilege the whole learning process.

The students said that the studio was fun and motivating: many students described the class as "attractive learning environment". Discussions with the students reveal that some prefer group work in the initial stages of conceptual designing, whereas few students prefer individual work at all stages.

Many students felt that the studio demanded too much time. Nevertheless, students willingly spent more time than the specified studio time. Discussions and analysis of designs continued out of the studio time during the instructor's office hours and by e-mails. The majority of students used e-mails and sent their inquiries in word, image, or modeling format to have replies for their thoughts and design ideas even between the weekly two scheduled times of the studio.

To evaluate the studio and the effectiveness of the learning environment, students were engaged in both formal and informal evaluations. Almost all students rated the studio as an exceptional rating. They also reported that the studio provided an intellectual level that is much higher than their similar studios. All students said that they have a motivational quality that drives them to innovatively build up their concept and problem definition in their future work.

From the instructor/researcher's point of view, tracking the influential factors of both conceptualization and problem definition, and recording how each factor had certain impact or no impact in some cases according to each student's design thinking, is the most important pedagogical objective students gain.

6. CONCLUSION AND FUTURE RESEARCH WORK

The research analyzed and reported the results and outputs of the investigations conducted in the design studio, and the questionnaire responses of both students and instructors.

This research paper is a part of a research project that has been conducted during the studio. The research project has investigated the use of digital media along with the focus area of this research paper. The research project has more two areas to be investigated and reported in researches: one is of the solely digital use in the design method presented by this research, and the second is of combining both areas of computer use and the reciprocal relationship of conceptualization and design problem definition.

The focus points of the research project are important to the pedagogical environment of the design studio as they enable to explore architectural design capabilities. To propose a design method and then to measure the responses in terms of its effectiveness help in exploring new paths and ideas of how students gain and learn certain design capabilities.

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