The Exploration of Creativity through the Architectural Design Educational Process

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Abstract:

Creativity, Knowledge creation, and the ability to innovate are among the most important and effective subjects in education. Therefore, it is constantly discussed when working on the development of various educational programs. Architectural education in particular is an intellectual field of studying and experimenting, as architectural design education is fed by the intellectual curiosity, energy, and awareness of the learner (Yürekli, 2007). The research paper will therefore focus on exploring creativity within the architectural design studio, by proposing a set of steps and stages required by the architectural design educational process to create an environment that supports the student's innovation and creative thinking. The research also highlights the importance of using 3D architecture composition and interactive learning methods in educational stages within the architectural design studio and its key role in demonstrating and enriching the tools used to explore students' creative and innovative abilities. The proposed model examined through a case study of "Architectural Design Studio I" course with examples, and a survey is oriented to students and professors intending to measure the success of the modular course in achieving the course "Learning Outcomes", and also to measure its importance in achieving the research goals. The research concludes that teaching creativity through its methods will be making the students grounded in designing with and innovative creative ideas. Once students have acquired the knowledge content and skills needed before, they can handle the architectural design stages more easily, and also have multiple means to express their ideas clearly.

Key Words:

Architectural Education, Creativity, Educational Process, Architecture Design Studio.

الملخص

تعد المعرفة، والقدرة على الخلق والإبداع، والابتكار هي من أهم الموضوعات التي تتعلق بتطوير التعليم بشكل عام، لذا فإنه يتم مناقشتها بشكل دائم عند العمل على وضع وتطوير البرامج التعليمية في المجالات المختلفة. والتعليم المعماري بشكل خاص يشكل مجالاً فكرياً للدراسة والتجريب، والتطبيق، فنجاح العملية التعليمة في مجال التصميم المعماري يعتمد في الأساس على مدى فضول المتعلم، والوعى والطاقة المبذولة من خلاله، (يوركلي ، ٢٠٠٧). لذلك فإن الدراسة البحثية سوف تتناول في جزئها النظري أهمية استكشاف الجوانب الإبداعية لدى الطلاب داخل استوديو التصميم المعماري والذى يخلص إلى اقتراح منهجية تعكس مجموعة من المراحل والوسائل التي يمكن أن تتطلبها العملية التعليمية لمادة التصميم المعماري لتحقيق تلك الأهداف، والتي يراها الباحث هامة وضرورية لخلق بيئة مناسبة لدعم قدرة الطالب على التفكير والإبداع. كما يبرز البحث أيضاً أهمية ودور استخدام التكوين المعماري ثلاثي الأبعاد، وكذلك أساليب التعلم التفاعلية في المراحل التعليمية المختلفة داخل استوديو التصميم المعماري، ومردود ذلك على استكشاف قدرات الطلاب الإبداعية وتطويرها. تم اختبار

المنهجية المقترحة وتطبيقها كنموذج من خلال تدريس مقرر مادة التصميم المعماري (١) لطلاب السنة الأولى بقسم العمارة، كما تم من خلال الجزء التطبيقي من الورقة البحثية عمل دراسة استقصائية استهدفت كل من الطلاب والأساتذة، وذلك لقياس مدى نجاح المنهجية في تحقيق نواتج التعلم المستهدفة، وأيضاً قياس مدى أهميتها في تحقيق أهداف البحث. ويخلص البحث إلى أنه يمكن تحفيز الإبداع من خلال استخدام الأساليب والوسائل التعليمية التي تعمل على تعزيز وتطوير الأفكار الإبداعية والابتكار لدى الطلاب، وتدعم حصولهم على المعلومات والمهارات المطلوبة بحيث يمكنهم التعامل بسهولة مع مراحل التصميم المختلفة والتعبير عن أفكارهم بطرق متعددة.

الكلمات الدالة:
التعليم المعماري, الإبداع، العملية التعليمية، استوديو التصميم المعماري.

1. Introduction

Many theories and researches have discussed the influential role of the architectural space in human life, which has to meet the user's needs in terms of comfort and belonging, that is why the field of Architecture Education derives its importance from the fact that it is responsible for preparing the students for the profession by supporting their ability to create these spaces so that they are livable, meet the user's specific standards, and support the user's physical and psychological health through interaction with the environment. Due the importance of the subject of architectural design, which is taught primarily in the curricula of all the architectural education programs, through which concepts and information are presented together to stimulate the student's ability to create. The research aims to create a successful learning process that helps to enhance students' creativity and to examine the proposed teaching methods for students. The research study will therefore address, through analysis and discussion of practical steps and stages within the architectural design studio a methodology that highlights the importance of architecture 3D composition as one of the most important tools for creative thinking, together with cognitive thinking through the information and experience provided to the students, by actual practice and interactive teaching methods through the educational process and support by other tools such as interactive lectures, interactive assignments based on innovation and creation, and innovative methods of evaluation. After the development of the proposed methodology, it was examined in the applied part of the research and tested through an applied case study of "Architectural Design Studio I" with examples, delivered in the architecture department of Egyptian private university, for two years in a row.

2. Literature Review

2.1 Architecture Definition

There are various definitions of architecture, for example, defined as "The art and activity of building, designing and organizing the space and surrounds, to achieve the functional and recreational objectives associated with the human life activities of society and individuals" (Dizdar, 2015). Many architects who led architecture and whose work in their time periods have been highly recognized for being unique such as "Marcus Vitruvius Pullio" defined it as: "Architecture is the art of construction.", "Rem Koolhaas" also defined architecture as: "A messy adventure". There is no specific area that generates architecture, but it is a correlation

between many activities that merge in a way that cannot be determined. " According to Le Corbusier, architecture is "The starting point for anyone who wants to take humanity towards a better future". Frank Lloyd Wright, an American architect, theorist, and renowned urban planner, also asserted that architecture is the art and science that shape and reflect ideas. Architecture is the great human sense of oneself embodied in a self-made world.

2.2 Architectural Education

Architectural education can be defined as the study of design that derives its origins from creativity. Encouraging and rewarding creativity is crucial in all fields, but it is also particularly important in the field of architectural education (A.A. Potur, 2006). The "Main Strategy for Architectural Education" can also be defined as the process of teaching and learning to build and shape a "new thought," "information" or "product design" through the cognitive accumulation of the process over time. Architecture is an area of thought for study and experience, design (architecture), and education depends on attention and the pursuit of ideas, energy, and awareness (Yürekli, 2007).

2.3 Architecture Design Studio Role in Architecture Education

A design studio is where students receive the required amount of basic knowledge about architectural design. The main objective of learning architectural design within the studio is to test many experiments based on the principle of skills development and exchange of ideas to help make appropriate design decisions. The architectural design studio is the place where students are connected and motivated. One of the most important problems facing the educational process is that there isn't a method that suits every student, because there are differences in design perception, as well as individual skills of creativity and innovation that are linked to the student's ability to think and design individually. The educational process within an architectural design studio can succeed through interaction between a range of elements: "The design studio is a means of communicating with students," "The design process's knowledge content," "The design problems are raised" and "The teaching and learning methods used," As well as the people involved, the learning process and the students". (Paker-Kahvecioğlu, 2001, Nurbin PAKER 2007)

The "Architectural Design Studio I" course is considered to be the first interaction between student and architecture, and its main objective is, therefore, to develop the student's ability to understand the spatial dimensions in architecture, thereby enhancing students' ability to imagine while designing, and to allow them to develop designs, shapes and architectural blocks that are balanced between aesthetics and functionality.

2.4 Knowledge, Innovation and Creativity in Architecture Design Studio

At early stages in the early 20th century, creativity was considered to be an innate nature in which man was born and distinguished individually, closely related to the arts but growing to include science. Creativity was seen as "The production of thought, stages, or any output produced individually in a short period of time," (Amabile, 1991, Nurbin PACKER 2007). But with the advent of the 21st century, much scientific research has confirmed that creativity is an interactive and sophisticated process that leads to innovation, a learning habit that requires skill

and a specific understanding of the contexts in which creativity is applied. The creative process is at the core of innovation and the two words are often used interchangeably, which is complementary to creating community sense and solving problems and therefore requires collective training through various education programs (Craft, A. 2000).

Webster's Dictionary defines the term "creativity" as "creative work, creativity; the creation of a new object, form or stage; the result of an act or conduct; It's produced with a unique talent. " Basically, creativity means, in simple terms, seeing a relationship between new information and previous experience and developing a new composition from this perspective (Packer- Kahvecioğlu, 2001). According to Albert Einstein, "Imagination is more important than knowledge, knowledge is limited to everything we know and understand now, while imagination embraces the whole world, and everything that can be known and understood." Creativity does not mean collecting knowledge as such, but is what we can do with it, (Quintin, 2009, p. 3).

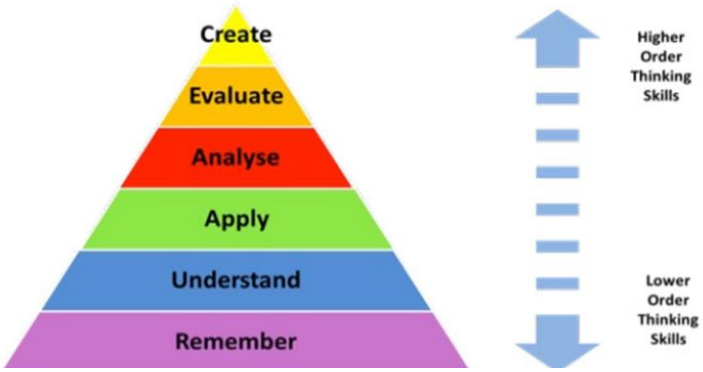


Fig. 1 Revised Bloom's Taxonomy, 2001, (Krathwohl, 2002).

Bloom, B.S., a well-known education researcher, identified three main learning objectives: cognitive, emotional, and psychokinetic, developed its famous "Bloom's Oriental 1956 taxonomy" classification of the cognitive field so that its gradient depends on thinking behaviors, which go through a range of stages, starting with the summoning of information, through the ability to understand, apply and analyze, and evolving into the ability to structure and evaluate. Through a modified and revised version by Krathwohl researcher David Krathwohl, he added creativity to Bloom's classification (Fig. 1), ranking him at the highest point in hierarchical gradient after the ability to evaluate and thus the highest skill of thought to be gained, (Krathwohl, 2002). This emphasizes the importance of creativity and that it should not be characterized as one of the student's potential, but as the objectives of learning outputs that can be improved and developed.

On the other hand, there is a debate about knowledge and creativity that brings contradictory results. The first theory is that creativity increases as the knowledge of the designer increases. Creative thinking can only arise through the integration of information and the creation of relationships. The creative aspect of the student can also be enhanced through training (Parnes & Noller, 1972; Torrance، 1990).

The second theory is against the first, that is, the increase in knowledge leads to a decline in creativity (Dunin-Woyseth, 1996). Since architectural design in universities is an educational course stimulating the true stages of the architectural design project by establishing the design principles and stages of the design process as well as the development of creative thinking in the student, Shan also pointed out that besides teaching students to acquire theoretical knowledge, this knowledge must also be transformed through creation and creativity into actual practice (Chan, 1990). Timor (1993) suggested that in the early years of architectural education

we could focus on the creative aspect of thinking without adhering to the intellectual aspect while raising awareness among students of their responsibilities to the outside world, while in the advanced years they could be more concerned with professional strict while providing opportunities for intellectual adventure. (Dizdar, 2015).

Many researchers in the field of education development have been interested in identifying and defining creative work. It represents an approach in which we can focus on how the students use knowledge, explore their creative motivation in integrating ideas and creating new ones, rather than just receiving knowledge on its own. For example, Professor Teresa Amapelli of Harvard Business School, who specializes in education, asserted that "creativity is the production of new and useful ideas in any field," and strongly supported the intellectual trend that "creativity as a phenomenon can be acquired through (time, experience and education)," (Amabile, 1996), According to Michael Mumford, "Innovation must involve the production of new, useful products" (Mumford, 2003). York defined creativity as "the ability to be original or innovative and to apply horizontal thinking" (Luuca, Eleonora 2014).

Since the purpose of the study of architecture courses is to prepare students for the rapidly evolving job market so that many jobs are introduced that did not previously exist, and concerning architectural design, in particular, new types of buildings are always being developed to meet the evolving needs and requirements of users, and the future also awaits much. Specialists must therefore work to qualify the student by developing architectural design courses and teaching methods during the design stages so that the student can adapt to problems and find innovative solutions.

3. The proposed “Architectural Design I” Course

“Architectural Design I” is the students’ first interaction with architecture, thus its main objective is to develop students’ imagination in design and allow them to create architectural designs that have dialogue and balance between poetic and pragmatic thinking. It also aims to introduce the vast definitions of architecture as well as its major principles and elements. The course comprises a set of basic techniques linking both theoretical and real aspects of architecture, and it is finalized by a small-sized project, and uses 3D composition as a major tool of creative thinking in all the educational processes.

3.1 Developing Creativity in “Architectural Design I” studio

Creativity, according to the investment theory, is mainly a decision and suggests that creativity can be developed. Simply requesting students to be more creative can make them more creative if they believe that creativity will be rewarded rather than punished, (O’Hara & Sternberg, 2000–2001). Sternberg and his colleagues believed that creativity requires a confluence of six distinct but interrelated resources: intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment, (Sternberg, R. J., 2006).

The proposed “Architectural Design I” Course focus is to promote the students’ knowledge and development of their own creative design concepts by incorporating the development of students’ intellectual skills stressing the creative thinking process and spatial composition, with enhancing the social environment context using interactive learning methods.

3.1.1 Knowledge

Knowledge is the information that we have developed through the experiences of previous generations as well as our experiences in the present, information can be gained from everything that has been explored, tried, and practiced as well. Knowledge can also be defined as "The ability to summon or remember facts and ideas without sometimes having to be understood" (Johannsson, p. 104). Knowledge is the theoretical and practical understanding of a subject that comes from learning, although, creativity is the use of imagination or ideas to create something, it is required to have knowledge to produce new results and solutions. Creativity finds a way to solve problems, and knowledge alone can be useless, if we can't explore and link the relationships in the information we know, as relationship between them is reciprocal.

Architectural design is one type of problem-solving, involving a series of steps to be taken to solve the design problem (Chan, 1990). For example, if the project's design program, which includes a list of spaces that needs to be transformed into a building, in a location with certain parameters and constraints, is considered to be a design problem, the architect's role here is centered on finding the best solution to solve this problem, which is represented in the final project through a set of steps called design phases, in which the architect integrates set of design standards and requirements such as functionality and aesthetics. A student within an architectural design studio is formulating ideas based on individual knowledge and life experience, and those given to him by course instructors through a range of lectures, interactive activities, and assignments to develop a set of scientific concepts.

Although the architectural design itself is a creative process based on innovation at different stages, its teaching stages within the design studio do not take this aspect into account. However, the students can acquire many of the skills that they did not already have but that have been highlighted and developed through the learning stages, the elements of which are defined when developing the course. This is discussed in this research study, which discusses and proposes a set of "learning stages," "teaching methods," "teaching tools," and "evaluation methods," which have already been applied by the researcher in the "Architectural Design Studio I". The researcher has written down his observations as well as the views of the students on the effectiveness of the curriculum offered to stimulate, encourage and develop the exploratory aspect of creative thinking and innovation for students with the subject, and the proposed course will be presented below.

From the above, it is clear that attention must be paid to the intellectual aspect together with the creative aspect of architectural education. It provides the student with information that is needed to understand the design requirements and bases of architecture design, and that if they are integrated, the student will be able to gain information interactively through practicing, as well as practicing to find innovative solutions to different design problems, which can be covered through the stages of the educational process in architectural design courses.

3.1.2 Developing Intellectual skills in “Architectural Design I” studio

Creativity starts with a decision of generating new ideas, analyzing these ideas, and selling them to others. In other words, a person may have synthetic, analytical, or practical skills but cannot apply them to problems that involve creativity. According to Stenberg, the creativity of students

can be developed by focusing on and developing three mental skills, (Sternberg, 1985) (Adams, Karlyn, 2005).

(a) Synthetic (Creative- Ability to Structure Creatively):

It is the ability to generate new, appropriate and important ideas through the ability to redefine problems effectively. This requires gathering ideas, trying to structure them creatively together, thinking deeply about the solutions needed, and getting the final product (projects). This skill can be enhanced among students within the "Architectural Design Studio I", mainly by using 3D composition in all levels of studio education and allowing students to express and discuss their ideas individually or in groups.

(b) Analytical capability:

The student's ability to participate in critical/analytical thinking by being able to judge the value of their ideas, assesses their strengths and weaknesses, and proposes ways to improve them. Through "Architectural Design Studio I", this skill has been encouraged, by allowing students to express their opinions and put forward ideas (students' projects), and then they can analyze and critique those projects, the ones done by themselves or their colleagues, identify their strengths and weaknesses and propose alternative solutions from their perspective to develop these ideas.

(c)Practical Application Capability:

It is the ability to apply intellectual skills in everyday contexts in a practical manner and also the ability to market creative ideas. This skill has been developed in students by linking project subjects to practical life and life experience. At the end of each assignment, students did a presentation for their projects to clarify and defend their ideas. Studies indicate that when students are taught in a way that emphasizes all three abilities, they surpass students who are taught in a manner that focuses solely on analytical abilities. According to “The Investment Theory of Creativity”, using the three skills together is also important. Analytic skills used in the absence of the other two skills results in powerful critical, but not creative thinking. Synthetic skill used in the absence of the other two skills results in new ideas that are not subjected to the scrutiny required to improve them and make them work. Practical–contextual skill in the absence of the other two skills may result in societal acceptance of ideas not because the ideas are good, but rather, because the ideas have been well and powerfully presented, (Sternberg, R. J., 2006).

3.2 Developing Creative Thinking in "Architectural Design Studio I"

Kampylis and Berki also defined creative thinking as "Thinking that enables students to apply what is in their imagination to generate ideas, questions, and hypotheses, to experiment with alternatives, and to enhance their ability to evaluate their ideas and those of their peers in the final steps and product.", (Kampylis and Berki, 2014). Traditional education systems do not have the capacity to support creative thinking or creative students, because sometimes creative thinking may not go with the required curriculum, and this causes students to ignore and avoid their creative skills because they eventually will not be accepted by the instructor, (Oliver et al., 2006). Hennessy, 1996, argued that the many approaches in education: "Expected reward," "Expected evaluation," "Surveillance", "Time limits" and "Completion" are all elements that destroy students' inner impulses towards free-thinking and the desire for innovation, while many higher academics adopt a different approach to space and promote internal motivation for creativity and innovation, (Jackson, 2006). Educational process and organization in the architectural design studio must be formed based on enlightening creativity that creates an expressive spatial understanding of the architectural design studio, (Boys, Jos, 2010), accordingly, using creative thinking methods in addition to the acquired knowledge through educational processes leads to creative design, (Fig. 2).

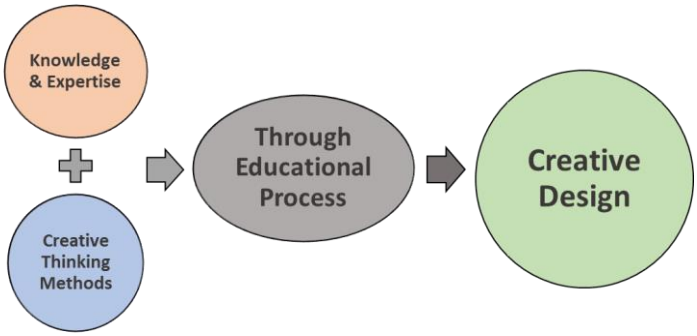


Fig. 2 Creative Design Process

3.2.1 Creative thinking Process

Everyone has the potential to become creative as long as they effectively use traditional intellectual processes to produce non-traditional creative outcomes. Recently, many researchers have gone on to study what is known as “Creative Cognition” within Architectural Design Studios, trying to understand and identify cognitive processes that produce creative ideas. This approach identifies two types of cognitive processes that have a role in creative thinking, (Fig. 3): (Hakak, A, N&A, 2014)

- Generative Processes.
- Exploratory Processes.

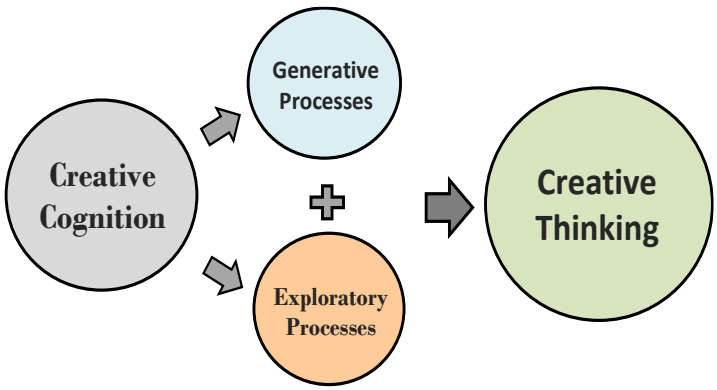


Fig. 3 Creative Thinking Process

The “Architectural Design Studio I” applied the previous two phases to a set of steps: First: Students search or gather the information that helps them stimulate the generation of ideas, in groups through group discussion and Google search. Second: Identifying the most creative ideas. Third: Choose ideas that can be modified and developed into a new product (3D composition) of innovation in so-called exploratory phases. This strategy is accompanied by the expansion of the concepts by the feedback of the instructor.

3.2.2 The 3D Architecture Spatial Composition as a major tool of creative thinking

Space and mass are the raw materials of architectural form, where architects use these elements to form a single composition, which must be characterized by unity, integration, and interrelation. At advanced educational stages, engineers in all fields rely on methods of visualization like (2D & 3D) drawings, illustration images, and different modeling techniques in the form of two and three-dimensional representations to illustrate their ideas and to transform the invisible world resulting from their imaginary abilities into a visual world. The Use of physical model in design process has a lot in common with elements of creativity theory in fact, on early stages of design process; it is equal to "Intermediate Impossible" from Edward de Bono theory. Working with physical models gives better results in architectural education. Matthew Frederick in his book "101 Things I Learned in Architecture School" P. 72: Three.-dimensional models - both material and electronic – can help you understand your project in new ways. The most useful model for designing is the building massing model – a quick material (clay, cardboard, foam, plastic, sheet metal, found objects, and so on) study by which you can easily compare and test design options under consideration. And from an interview on "Education, Research and Practice in Architecture" / by Jan Schevers TU Eindhoven, Stephen Bate said so "I think the model making, which you can see in our office, is such a fundamental part of designing. We have to build it and see it. But actually of course I know that we do it because we see opportunities in that process. So we'd like to encourage the students to realize that models are a tool, just like a computer is. The paper or foam board models in this studio and in our teaching studio are really the kind of focus of work.

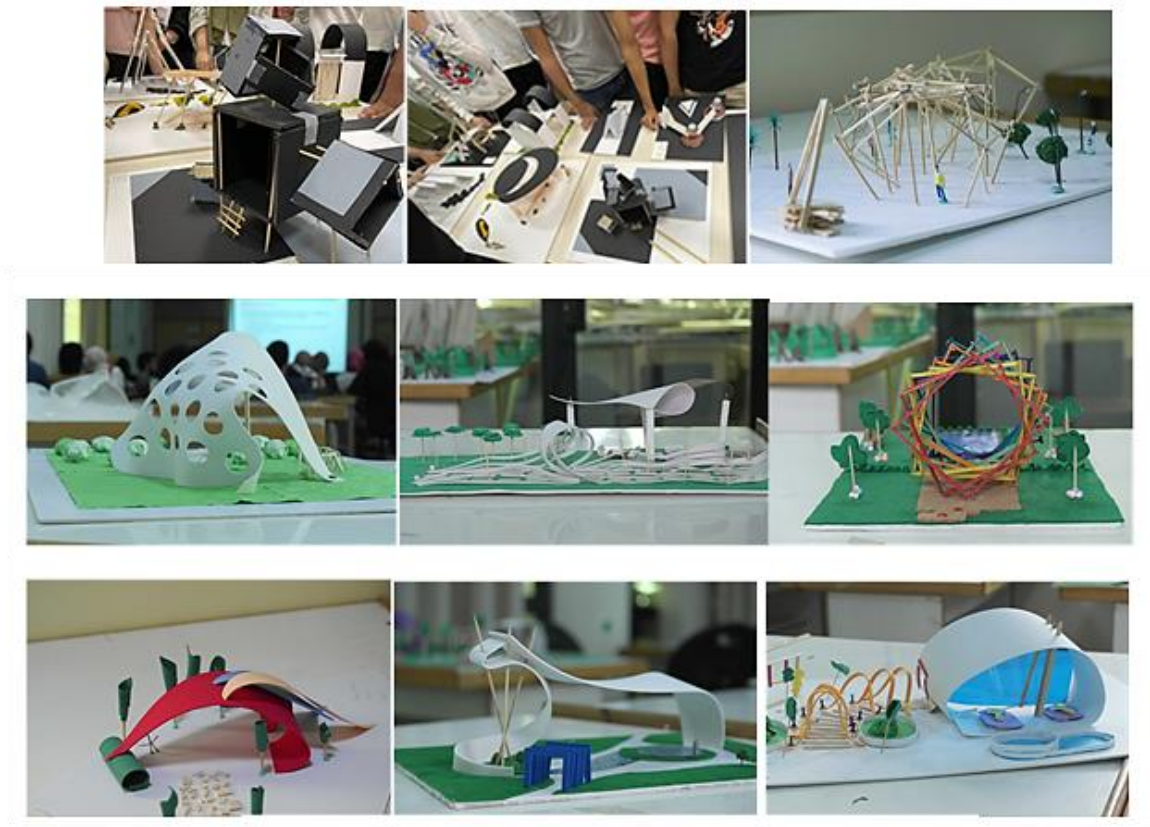


Fig. 4 Architecture Design I, students' 3D Composition Examples

From this point of view, creativity and innovation were the main theme of "Architectural Design Studio I". The course highlighted "The architectural 3D composition", stressing the concept generation and the development of a rich design process to create spatial experiences. So, we had three main phases, each phase started with the architecture composition as a key element of improving students' creativity and innovation.

Students at this primary stage had no previous experience in architecture, and cannot, therefore, show their ideas and explain them appropriately, that is why 3D composition has been used mainly at all levels as a first step towards creating ideas and presenting them, (Fig. 4). This is to stimulate the students' creative and innovative ideas without complying with the lack of cognitive abilities to express through architectural drawings and other known methods that the student will learn in later stages of the course.

3.3 Learning Environment

Vygotsky believed that learners are subject to the influence from the external environment, that is, social (interpersonal interaction) environment, (Vygotsky, 1977). He stated that "One needs an environment that is supportive and rewarding of creative ideas. One could have all of the internal resources needed to think creatively, but without some environmental support (such as a forum for proposing those ideas), the creativity that a person has within him or her might never be displayed", (Sternberg, R. J., 2006). Bandura also believed that learning is a lasting process of behavior changes through experiences and practices. It is subject to the influence of the continuous interactions between an individual and his/her social environment, (Bandura, 1978) (Melian and Gutierrez, 2020). He also believed that learning is a long-term process of behavior changes through experiences and practices. It is subject to the effect of the continuous interactions between students and their social environment. Therefore, Bandura proposed the concept of triadic reciprocity, emphasizing that student could acquire specific response behaviors through learning. Students observe an object or an incident, learn how to respond to the object or incident based on their own thoughts and past experiences (external environment), and then attain what they have learned in their memories (cognition). A students' behavior is the reflection of what they have learned. When facing similar incident (external stimulation), they will take the same behavior (action) in response. The series of learning activities involve external stimulation, and, therefore, it is called "social learning," a major channel to learn social behaviors.

3.3.1 Interactive Learning in "Architectural Design Studio I"

Architectural education is a combination of theoretical and practical knowledge that enables students to use these theories and technical knowledge to create the ideas that shape the society we later will live in. Active learning-based methods have a great role in supporting the participation of students and helping them to understand, reflected in creativity and innovation, the inductive teaching has better results than productive teaching, (Adler, 1999). And students who learn architecture more interactively and have space to ask questions, learn concepts better, memorize information easily, and can apply what they have learned more effectively in other contexts, than students who sit passively listening, (Wood W., 2006).

Hence, it is important to use active learning strategies in architecture education. Bonwell & Eison (1991) have proposed several techniques to support and promote active learning:

- The use of visual media during the lectures.
- The encouragement of students to take notes during lectures.
- The use of computers during teaching.
- The encouragement of students to solve problems during the case study.
- The use of simulations, role-playing, and various graphics.
- The use of collaborative learning.

3.3.2 Interactive Teaching and Learning Methods in "Architectural Design Studio I"

Active learning requires appropriate environments through the implementation of the correct strategy. Teacher-Student Interaction: Using Suitable Teaching Materials and Methods to Guide Students in Their Learning. In the "Architectural Design I" course the main objective was to develop a broad perspective for students concerning the fundamental factors that shape and affect architectural design. So, we applied different teaching methods that help in reach better understanding of such as:

- Interactive Lectures, (visual media and discussion).
- Interactive Group Assignments and Activities, (discussion, brainstorming, and presentations).
- Different Methods of Evaluation, (feedback and evaluation).

a. **Interactive Lectures**

The lectures were designed to coincide with the students' required assignments, providing them with the knowledge and information needed for each stage. Activities were relied upon to complement the rest of the knowledge, to enhance the student's ability to acquire the needed information, and also to develop their research and analytical skills.

b. **Interactive Creative Group Assignments and Activities**

"Creative environments are described as organizations (groups) that enable the production of knowledge and facilitate learning from experience and one another as they provide participatory knowledge" (Özçer, 2005). It is through which ideas and information from different sources are shared and combined, leading to participation and interaction among the group members. Creativity can be both individually and in groups (Wolfe, 2002). Recent trends in globalization also focus mainly on the transition of the role of knowledge and creativity from the individual to the collective group (Özçer, 2005). Creative environments built on teamwork among groups of students play a major role in facilitating learning through, sharing experiences, sharing knowledge, integrating information from different cultures and backgrounds, thereby encouraging students

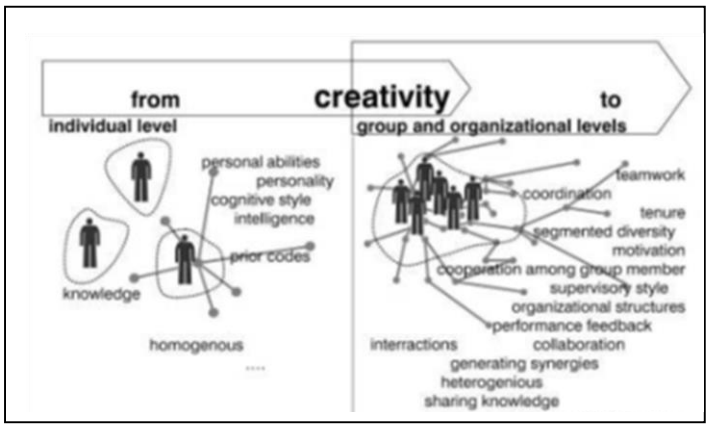


Fig. 5 Knowledge and creativity move from an individual to an organizational level, (Nurbin PAKER 2007).

to interact and participate and thus reflecting creative output in general, (Fig. 5), (Nurbin PAKER 2007).

Vygotsky stressed that rich social and cultural contents will influence the cognition of learners. He also believed that elders and peers with more experiences can help learners to internalize new knowledge into the foundation of their knowledge, **(**Vygotsky, 1977). The influence of the external environment is particularly significant when people are learning a language. With better language skills and knowledge, one will become more capable of communicating with others, which will lead to a series of continuous changes in his or her thinking and behaviors. Such changes vary significantly among different individuals due to their personal and cultural differences. Therefore, the development of cognition can also be seen as a process of social adjustments, (Yun, Huang, and , Weng, 2014).

Cooperative learning, broadly defined as an educational opportunity in which students learn from one another, has taken numerous forms (e.g., Cohen 1994; Johnson and Johnson 1994; Johnson, Johnson, and Stanne 2000; Kagan 1985, 1993; Slavin 1986, 1990). With roots in theories of social interdependence, collaborative learning has been very successful when implemented well. Team learning is closely related to cooperative learning, and according to Senge (1990) "team learning is the process of aligning and developing the capacity of a team to create the results its members truly desire", (Wilsonand Peterson, 2006). Working on developing creativity for a group of students requires focusing on modern scientific approaches and methods that help to detect individual creativity by working in groups to identify problems, the ability to find different and unusual solutions to them, as well as the ability to express and connect different elements, and then develop the skill of individual thinking for those who could not do so. Active learning-based methods have a great role in supporting the participation of students and helping them to understand, reflected in creativity and innovation, the inductive teaching has better results than productive teaching, (Adler, 1999). Students Instructor Interaction and Student-Student Interaction in group discussions, the students have to communicate face to face with the instructors and their colleagues and constantly have self-reflection to find the best solutions to their problems. Student-Student Interaction increasing the opportunity of growth for students through mutual discussions and learning. And according to the theory of social learning, a learning process can be mainly divided into two stages: observational learning and imitation, (Bandura, 1978) (Melian and Gutierrez, 2020). In the process of social learning, students can learn from each other through observation and critiques as they can integrate what they learn to alter their own designs. Through the interactions between their external exchanges with classmates and their internal cognition, students can gain extra new knowledge. When solving their design problems, students can interact with their classmates through discussions and exchanges experiences, results. Through this method, students can develop the capabilities of thinking critically and innovatively, finding the causes of problems, exploring methods of improvement, and creating more diversified solutions. Therefore, learning interaction is a very effective learning tool to enhance students' design competence.

This was followed at "Architectural Design Studio I", where the one in charge of the education process, divided students into groups at the beginning of each activity, whether individual or collective so that discussions and exchange of ideas would take place between the members of the same group. In the beginning, the required activities were all collective, and the product to be accomplished was the expression of ideas through a three-dimensional structure in which all the members of the group participated, which allowed those who cannot be creative to share their ideas, try to develop them and express their opinion and thus interact significantly to accomplish what is needed. Asking questions and discussions leads to a better and deeper understanding of the required knowledge as imagination can play an important role as it allows students to reach areas of thought that are difficult to reach by traditional methods.

Fig. 6 Architecture Design I, Group activity

In "Architectural Design Studio I" the group assignments, were used extensively and often delightfully, asking students to do a Google search on the questioned subject, and leaving them to discuss with each other to choose a range of keywords and sentences that clearly express their opinions and ideas. Groups compete joyfully, but keeping close to the objective, they display that information and images on a board to present their point of view through debate between groups, (Fig. 6). Finally, the instructor arranges these ideas and highlights the gained knowledge by confirming them.

c. **Different Methods of Evaluation**

One of the important tools that support creative thinking is the students' diverse evaluation methods, so the course is based on a set of evaluation methods that depend not only on the instructor's assessment but also on the student's self-evaluation, and also on peers' evaluation for each other.

- ***Interactive Feedback***

Feedback or the information about the results means acquiring information about an action that has been carried out. A person who gets information about how right or wrong what he/she does and says can learn more easily, (Kaya, and Akdemir, 2016). The principle of discussing with the students to understand problems and to try to find alternatives rather than giving them a direct solution is very common today. So, in "Architectural Design Studio I" we start with "Peers Feedback", that helps in highlighting problems in a simplified way, expanding the ability to objectively criticize and express problems and then to think logically to find solutions on their own without affecting the thinking process. Then comes the role of constructive criticism by the instructor, through which he sheds light on problems more clearly and provides optimal solutions that are characterized by scientific information and knowledge required at that stage, (Fig. 7).

- ***Evaluation***

Fig. 7 Architecture Design I, Interactive Feedback

Evaluation is defined as making judgments for some purpose about the value of ideas, actions, solutions, methods, etc, (Alhalwagy, 2019). "Biggs, 2003", confirmed the strong relationship that must link each of the teaching curriculum and methods of evaluating it. and stressed that evaluation should reflect the elements of the curriculum and that its activities should converge teaching and learning to achieve the same objectives to be ready for final assessment, (Alhalwagy, 2019). There are two types of evaluation as follows:

- **Formative Assessment**

It is an assessment with the aim of learning, so it is carried out at the beginning and during the teaching process to measure the students' cognitive outcomes and the extent of their understanding and comprehension of the material presented, as well as what they can do as a practical application of what they have studied. Formative assessment is defined as "All activities performed by instructor or student to evaluate himself ". As a result, the necessary information is available to modify the teaching and learning activities in which students participate.

- **Summative Assessment**

A summary evaluation is the last stage of evaluation for students' experiences during a learning period, and its purpose is the evaluation of the student's final level and knowledge attainment after the completion of the course. The summative assessment was defined as "The final evaluation of the course, which results in the student's final level of achievement ".

3.4 The Proposed Architecture Design I Educational Process in Design Studio

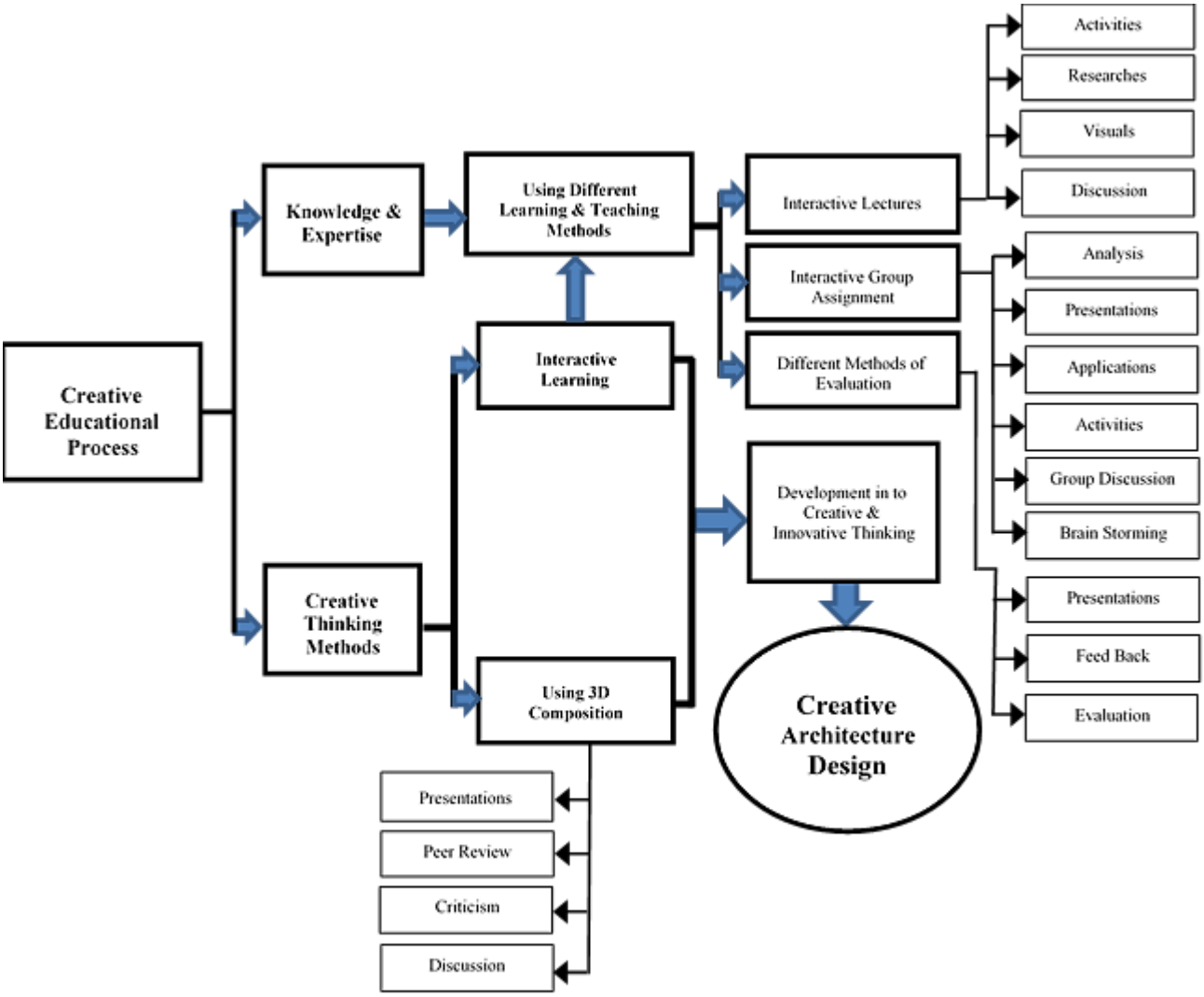


Fig. 8 Architecture Design I, Educational Process example

4. The Course Discerption

The proposed educational process was examined through the “ASE 251” Architecture Design I Course for the 2nd year students. "Architectural Design Studio I" course aims to develop a broad perspective for students concerning the fundamental factors that shape and affect architectural design. It presents special rules and compositions that aid in developing students’ basic presentation and communication skills. The number of students attended the course were “119” student, divided into “3” groups. The course duration was “14” weeks, divided to three main phases as follows:

4.1 Phase I: "Free Project"

The free project examined the student's natural ability to explore "the 3D composition" as a tool of creative thinking. Without any architectural background and in a group work of 3 to 4 students, the students were required to create a free composition with available objects and materials. After completing this model, the students were able to introduce the primary volumes

and their variations, explore the composition principles such as scale & proportions, unity, balance, etc.

Phase I constrains are:

- Duration: one-day project.
- The number of students: group work 3-4 students.
- Materials: any available materials and objects.
- Requirements: create a free 3D composition.
- Criteria of evaluation are: to apply “Balance, Integration between Objects, Shade & Shadow, Creativity, and Innovation”.

4.2 Phase II: “Tinny Architecture Project"

Was about "Developing Creativity", so the students explored "architectural composition" that leads to developing concept ideas. After having a "Composition Principles" lecture, the students were required to create a 3D architecture composition for "An Outdoor Playing and Activities Area", considering "Principles of Composition", and then take different shots for the model sides and print it to trace the outlines of the model views and apply shade and shadow, with regards to a light source. After completing this phase the students were able to demonstrate knowledge and understanding of basic spatial compositions such as: introducing the primary volumes and their variations, performing multiple transformations and operations on masses such as merging several volumes to create a composition, exploring and introducing the basic functional relationships and exploring the various alternatives of a spatial organization through utilizing the concepts of axis, hierarchy, datum, rhythm, etc. Phase II constrains are:

- Duration: 2 weeks.
- The number of students: individual.
- Materials: any available materials and objects.
- Requirements: create "An Outdoor Playing and Activities Area".
- Criteria of evaluation are: to apply “Balance, Unity, Circulation, Function, Creativity, and Innovation”.

4.3 Phase III: "The main project"

- Each student had to prepare a “Design Concept” for a “Kindergarten”. The main theme was (Creativity & Innovation), so we chose the kindergarten project which has a very simple program and clear functional spaces relationships that helped to focus more on creativity and innovation to achieve the integration between the indoor and outdoor spaces as one composition. We started the design process by creating study models which enhanced students' imagination and creativity, after understanding the main components of the project, students constructed a physical model (scale 1:100) by using the most appropriate material, focusing on zoning, circulation, outdoor spaces, and functional aspects.
- During the first two weeks of this project, the researcher had the main role of raising the students' understanding of all design considerations and standards needed and also the site constraints which were the starting point of thinking and solving design problems. Using creative assignments in this phase such as analyzing similar case studies to explore the different aspects such as functional relationships zoning, circulation, …etc., and also constructing a

physical model for one case study which helps in the more spatial understanding of the concept, articulation of masses, the relation between indoor and outdoor spaces, etc. After they had a "site analysis" lecture, the group work had to present their work in a 10-minute video showing the complete site analysis (Fig. 7) for the given site in terms of accessibility and approaches, environmental studies (sun, wind, daylight, etc..), visual studies (views, architectural style, iconic buildings, and urban fabric (existing buildings, heights, circulation, etc.…). This video had many distinct ideas for presenting information such as TV talk shows, graphic cartoons, educational TV programs, and documentaries, which made the subject interesting and stimulating for students to work on, as well as presenting it to their colleagues and instructors.

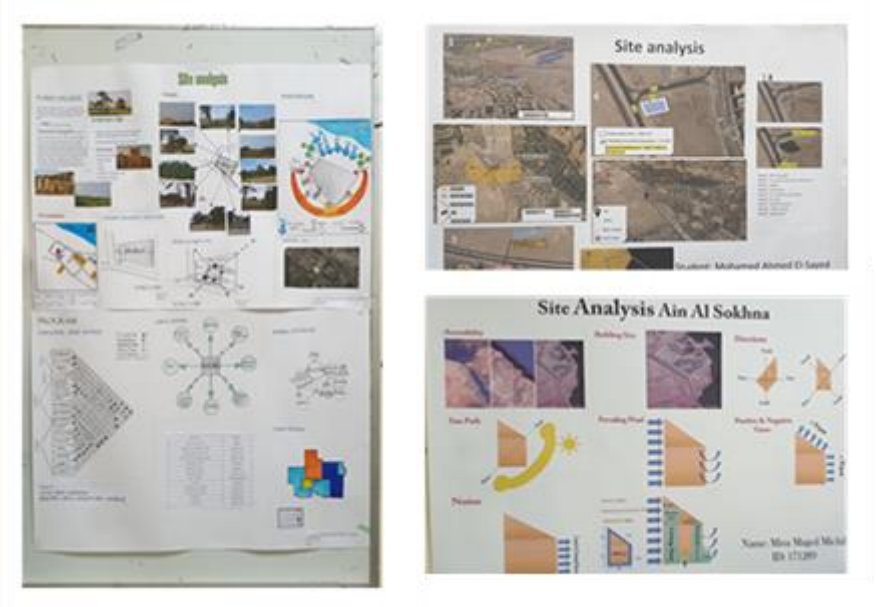


Fig. 7 Architecture Design I, Research example

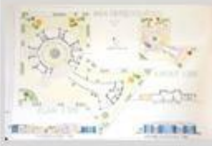
After the research stage, the student began to develop the proposed study model focusing on zoning, circulation, spatial relations, structural, and functional aspects, refinement of master plan and layout, and development of plans, sections, and elevations. And finally, the project final presentation. Phase III constrains are:

- Duration: 10 weeks.
- The number of students: individual.
- Materials: Modeling flexible materials.
- Requirements: create "A Kindergarten".
- Criteria of evaluation are: to apply “Form, Articulation of masses, Circulation, Function, Relation between indoor and outdoor spaces, Creativity and Innovation”.

The following table shows the detailed educational process using the following analytical indicators: objectives, phase duration, number of students, teaching methods, creative thinking methods (3D composition and creative assignments), evaluation methods, and learning outcome.

Educational Process	Objectives	Duration	Students No.	Teaching methods	Creative thinking methods			Examples	learning outcome "The student will be able to"
					3D composition	Creative Assignments	Evaluation methods		
Phase 1	Exploration of the composition principles	one day project	Group work 3-4 students	Brainstorming, activities, Videos, Examples.	**Free** 3D composition	▪ Individually sketching the final composition with a base plan in A4 sheets. ▪ Presentation for the projects.	Discussion, Self-evaluation, & Peer review	     	▪ Introducing the primary volumes and their variations. ▪ Exploring and introducing the composition principles such as: Scale & Proportions, Unity, Balance, etc.

Phase 2	Developing Creativity, explore architecture composition (architecture spatial organization), and explore design elements & principles	2weeks project	Individual work	Interactive lectures, brainstorming, activities, videos.	3D Architecture composition	▪ Photographing the 3d model with the mobile camera showing the four sides and the layout and then individually using a terracing paper to trace the outlines for each. ▪ Presentation for the projects.	Discussion, Self-evaluation, Peer review & criticism (Educator evaluation)	    	▪ Performing multiple transformations and operations on masses such as merging several volumes to create an architecture composition ▪ Exploring the various alternatives of the spatial organization through utilizing the concepts of Axis, Hierarchy, Datum, Rhythm, etc.

Phase 3	▪ Exploring the basic functional relationship. ▪ Investigating the design-spatial components. ▪ Achieve the most creative concept ideas and solutions.	10 weeks project	Individual work	Interactive lectures, brainstorming, activities, videos	▪ 3D study model. ▪ Physical model scale 1/100.	▪ Powerpoint presentation covering the following: case study analysis, the standards data needed for the project, and the site analysis. ▪ Study model for one of the case studies. ▪ Video presentation for all the research outcome data	Discussion, Self-evaluation, Peer review & criticism (Educator evaluation)	    	    	▪ Make a design showing creativity and innovation in applying various concepts of form and space and translating them into architectural ideas and elements ▪ Exploring and introducing the basic functional relationships. ▪ Integrate between indoor and outdoor spaces. ▪ Investigate the design-spatial components such as the entrances, the circulation elements, and the accessibility forms. ▪ Adapt to different site elements; accessibility, environmental aspects, etc.
								  	  	

5. Applied Study

The applied study aims to measure the effectiveness of the proposed model for first year students in the Department of Architecture in the various faculties in the Arab Republic of Egypt. The main hypothesis of the applied study is that all the elements of the proposed methodology are all of equal importance and have a significant impact on the success of the educational process of first year design I course students in Architecture Department. Therefore, the applied study relied, in determining its objectives, on the results of a questionnaire (Appendix 2), directed for two groups, A & B as follows:

Group A: the survey targets professors, lecturers & specialists at Architecture Department from several universities.

Group B: The survey targets group of "Architecture Design I" course students (25 student). The questions are divided into groups; Group (a) questions, intended to measure the success of the modular course in achieving the course "Learning Outcomes". Group (b) questions, intended to measure the importance of the "Proposed Model" in achieving the research goals.

5.1 Survey Results

5.1.1 Group (A), professors:

1- All professors and specialists emphasized the importance of gaining ideas and knowledge from different sources, shared and combined for developing creativity with 53.3% opinion that it is extremely important and 46.7% that it is very important.

2- 73.3% of the professors understand the importance of interactive lectures in enhancing the student's ability to acquire the needed information, 20% confirmed that it is very important, while 7% think it is somewhat important.

3- Most of the professors believe that using suitable teaching materials and methods are important to guide students in their learning, with 53.3% think it is extremely important and 46.7% think it is very important.

4- All professors agreed that "Activities" is the most effective method in interactive learning, followed by "Discussion" with 93.3%, "Visuals" 86.7%, and "Researches" with 73.3%.

5- Most professors think that creative environments built on teamwork among groups of students play a major role in facilitating learning through, sharing experiences, sharing knowledge, integrating information from different cultures and backgrounds, as 46.7% think it is extremely useful, 46.7% think it is very useful, while 6.6% believe it is somewhat useful.

6- All of the professors chose "Group Discussion" as the most effective method in interactive group assignments, followed by 93.3% for both "Analysis & Activities", "Presentations & Applications" in the same ranking with 86.7%, while they believed that "Brain Storming" is the least effective method with 73.3%.

7- Most of the professors agreed that creating 3D composition throughout the project stages is extremely helpful with 40% and very helpful with 46.7% in developing the student imagination skills, while 13.3% finds it somewhat helpful.

8- Most of the professors with 33.3% finds that using 3D composition mainly at all levels as a first step towards creating ideas and presenting them in design I course is extremely helpful to stimulate the students' creative and innovative ideas without complying with the lack of

cognitive abilities to express through architectural drawings and other known methods that the student will learn in later stages of the course, also 40% finds it very helpful and 26.7% finds it somewhat helpful.

9- 80% of the professors agreed that the instructor feedback, through discussing with the students to understand problems and to try to find alternatives rather than giving them a direct solution is extremely helpful in students learning development, as well as 20% agreed that it is very helpful.

10- Professors with 46.7% strongly agree that Peers feedback, are on the same level of knowledge and experience, highlighting problems in a simplified way, expanding the ability to objectively criticize and express problems and then to think logically to find solutions on their own without affecting the thinking process, and 33.3% also agree while 20% rather agree nor disagree.

5.1.2 Group (B), students:

- **Section (a): Learning Outcomes**

The survey results reflect that after completing the "Architecture Design I" course, the students will have the ability to do the following:

○ Demonstrate knowledge and understanding of the principles and factors that shape architectural design and basic spatial compositions, the results were as follows:

1- All of them can recognize the primary volumes and their variations.

2- Most of the students with 62.5% can excellently multiple transformations and operations on masses such as merging several volumes to create a composition. As well as performing additive and subtractive transformations thus generating an entrance, a protrusion, a balcony or a staircase, 25% are very good and 12.5% can perform in a good way.

3- 37.5% are excellent at exploring the various alternatives of spatial organization through utilizing the concepts of Axis, Hierarchy, Datum, Rhythm, etc., 50% are very good and 12.5% can perform in a good way.

4- All of the students can understand the basic functional relationships of kindergarten projects, excellently with 68.8%, very good with 25%, and 6.2% understand it well.

○ Demonstrate knowledge and understanding of the fundamental factors that shape architectural design, the results were as follows:

1- 37.5% are excellent at understanding the essential role of utilizing a module (Grid) in generating a spatial organization, 25% are very good, and 31.3% have good understanding, while 6.2% their understanding is fair.

2- 43.8% of the students can recognize the design-spatial components such as the entrances, the circulation elements and the accessibility forms excellently, 31.3% are very good at recognizing the components, and 25% can recognize it in a good way.

○ Most of the students improved their intellectual skills to relate principles and methods of design to various approaches and phases of the design process and performing vertical and horizontal projections of 3D models excellently with 56.3%, and very good with 37.5%, while 6.2% improved their skills in a good way.

○ Improve their Practical and Professional Skills and will be able to:

1- 52% of the students are excellent at studying forms and spaces and their organization, 24% are very good, and 20% are good.

2- 50% of the students are excellent at drafting, architectural presentation and physical model techniques, 37.5% are very good, and 12.5% are good.

- Most of the students with 56.3% improved their transferable skills and are be able to use communication skills efficiently, 31.3% are very good in communication skills, and 12.5% can use communication skills in a good way.

- **Section (b): The proposed model**

The survey results reflect that:

1- In Architecture Design I course, interactive lectures were designed to coincide with the students' required assignments, 62.5% of the students found the lectures were extremely effective to provide them with the knowledge and information needed for each stage, 25% found them very effective, and 12.5% feels that the interactive lectures were somewhat effective.

2- All of the students preferred "Activities "among interactive teaching methods used in the lectures, 87.5% preferred "Discussions", and 75% preferred "Visuals", while 37.5% preferred "Researches".

3- Most of the students with 43.8% assured that using group work assignments is extremely useful in facilitating learning through, sharing experiences and knowledge, also 50% assured that group work assignments is very useful, and 6.2% finds it somewhat useful.

4- The interactive group assignment used a group of learning methods, all students chose "Activities" as their favorite method, 87.5% chose "Presentations" and "Group Discussions", 62.5% preferred "Applications", and 43.8% chose "Brain Storming", while 25% preferred "Analysis" as their favorite learning method.

5- All of the students think that the instructor feedback, through discussing helped them to understand problems and to find alternatives rather than giving them a direct solution.

6- 31.3% of the students think that Peers feedback, are on the same level of knowledge and experience, is extremely helpful to highlight problems in a simplified way, and to find solutions, 37.5% think it is very helpful, and 31.3% think it is somewhat helpful.

7- 43.8% of the students think that creating 3D composition throughout the project stages was extremely helpful to develop their imagination skills, 37.5% agreed that it was very helpful, and 12.5% think that it was somewhat helpful, but 6.2% of the students think it was not helpful at all.

8- Most of the students with 43.8% think that creating 3D composition throughout the project stages was extremely helpful to express their thoughts and ideas easily, also 43.8% think it was very helpful, while 12.5% finds it somewhat helpful.

9- All of the students assured that the instructor was extremely engaging with 68.8% and very engaging with 31.3%.

10- 50% of the students rated the course with excellent, 37.5% with very good, and 12.5% rated the course with good.

5.2 Applied Study Results

Based on survey results, the “Architectural Design I” course learning outcomes been successfully attained through the proposed model for the Creative Educational Processes, also it has an important role in raising the students creativity and innovation through architectural design processes that lead to creative design projects.

6. Observations

- At the outset, it was observed that the students themselves were resisting change, given what they used to do. The idea of freedom of thought and creativity was not available enough in years of the previous study, although a great role in supporting a student's self-confidence and in their inner potential and ability confidence to innovate without having constraints by former instructors. After finishing phase I, it was observed that students are engaged with their instructor and colleagues in an interactive way trying to search for ideas that help them to create innovative projects. In the feedback stage, the students were fully focused on expressing their opinions on the other projects and being directed towards ensuring that the criticism is in a constructive scientific context.
- Opening up the discussion during the lectures led to greater self-confidence among students in expressing their opinions and even discussing and questioning the information at times, which helped to broaden the knowledge base on the topics in question positively. In the second phase, students became more confident in expressing their ideas and defending them. The development of students' skills to communicate with the educator and their colleagues was highly noticeable as a result of group work and discussion during the first step of each stage, and the collective or individual feedback. They also have increased their ability to criticize subject matter and express an opinion on their projects or their colleagues' projects.
- Students' use of three-dimensional composition to express their ideas at all levels of the educational process has been highly successful because of their lack of background on traditional architectural expressions (2D and 3D architectural drawings), which has helped to illustrate these ideas and to achieve the highest levels of creativity.
- Interactive assignments and activities played a great role in bringing about an atmosphere of fun with an in-studio focus that led to a great deal of students’ participation and a greater understanding of the topics involved. It promoted the student's ability to collect and analyze information, thus helping students to obtain innovative results and solutions, and supports the ability to express their ideas in a clear and structured manner. It also helped to deliver the required knowledge indirectly based on understanding and assimilation. The educator, through the course, has relied on a set of examples: (activities- presentations- applications- analysis). More-related assignments and activities are recommended.

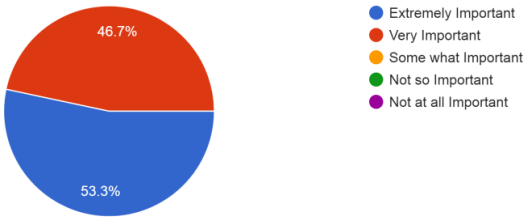
7. Conclusion

By integrating the elements of the proposed methodology, "Architectural Design Studio I" was able to achieve its educational goals and its main objective of exploring and promoting creativity among students, as evidenced by the results of student's projects, which were very complex and innovative, that were not expected of design I students, and whose projects were often simple or sometimes naive. In conclusion, teaching creativity through its methods will be making the students grounded in designing with creative ideas. Once students have acquired the knowledge content and skills needed before, they can handle the architectural design stages more easily, and also have multiple means to express their ideas clearly. Therefore we can have professionals that design and build with satisfaction, safety, and complementary. It means we can have real buildings and places that satisfy our clients, the society, and in harmony with the environment.

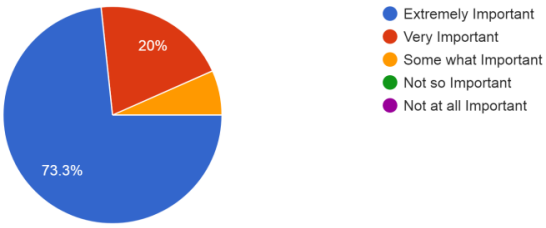
Appendix:

Professors Survey Results:

Question 1



Question 2



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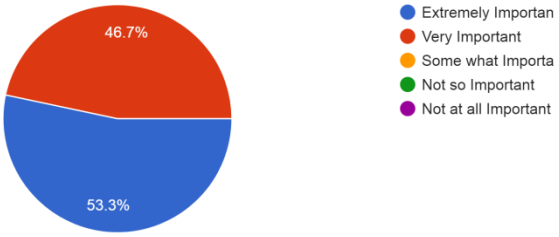

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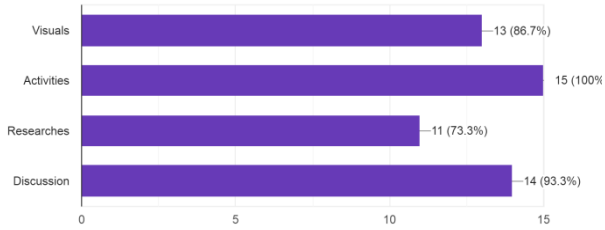
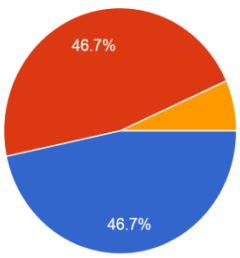


Question 5



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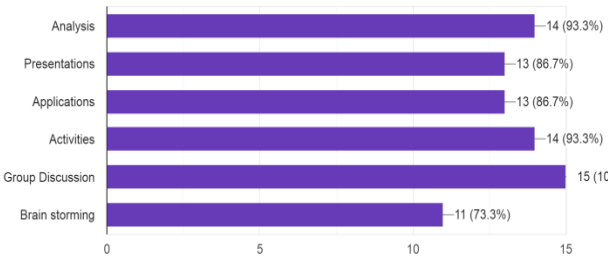

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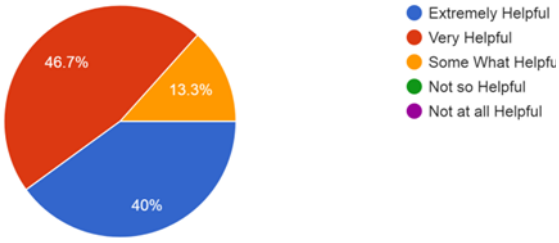

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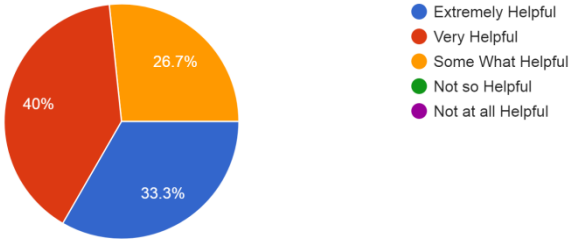
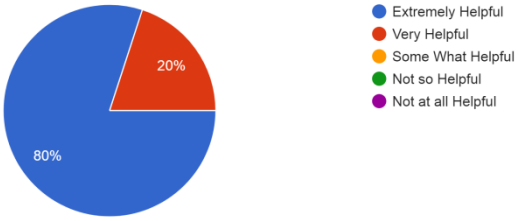
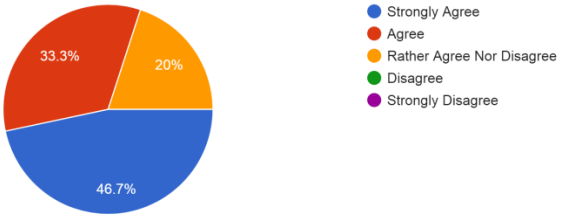


Question 9

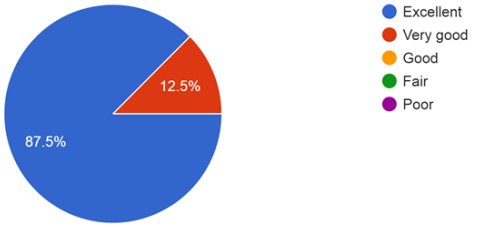


Question 10

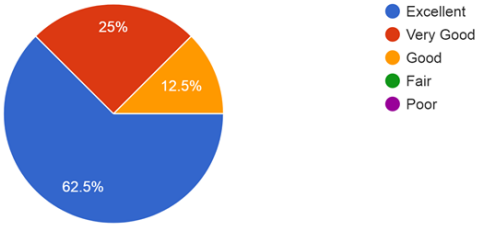


1- Students Survey, Group (A) Questions Results:

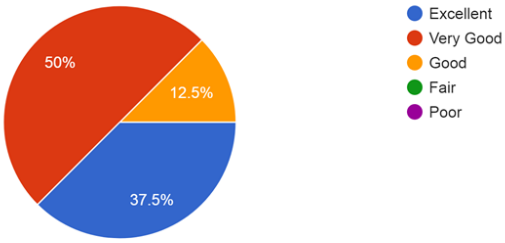
Question 1



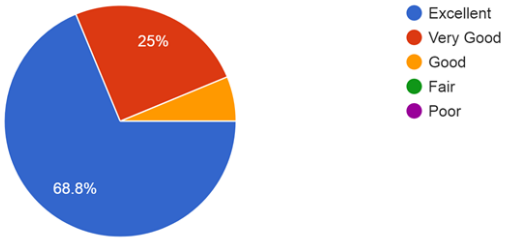
Question 2



Question 3



Question 4



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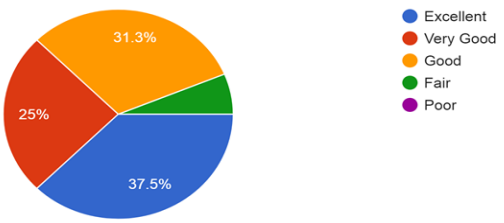

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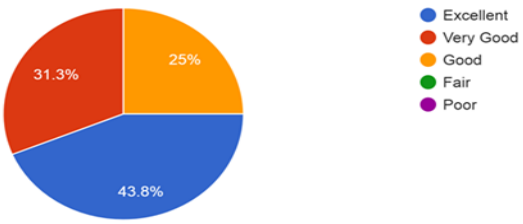

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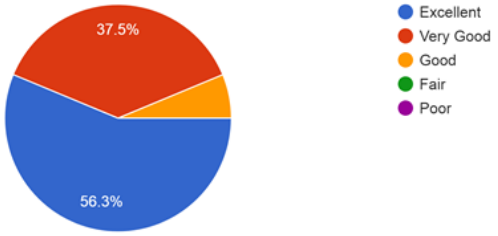

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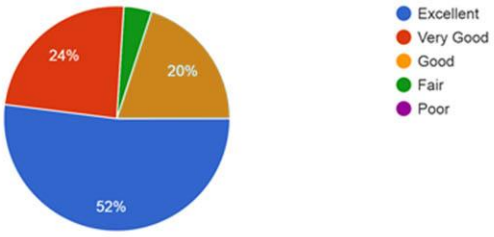

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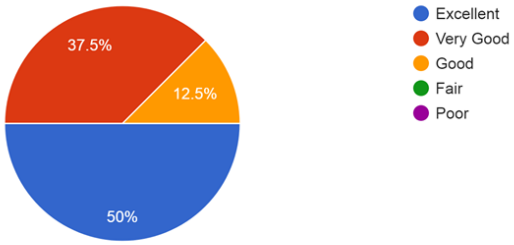

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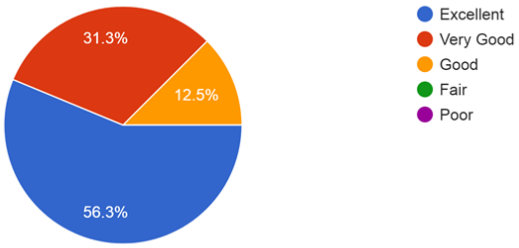
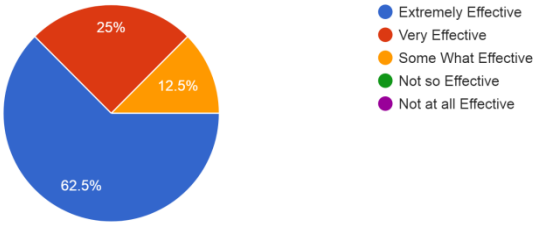
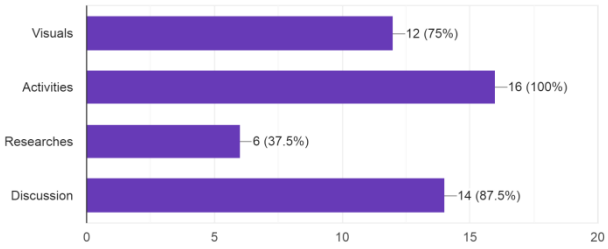


2- Students Survey, Group (B) Questions Results:

Question 1



Question 2



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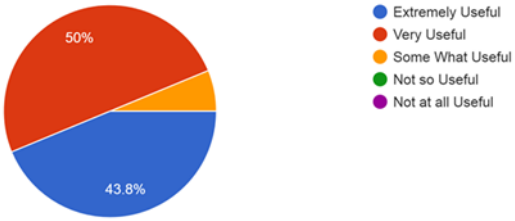

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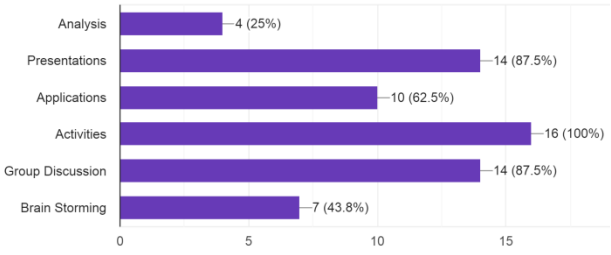

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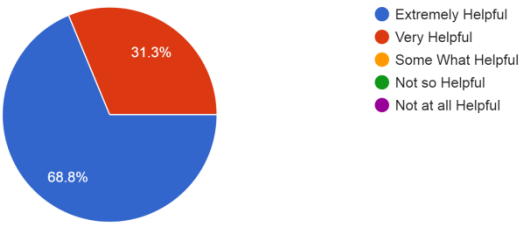

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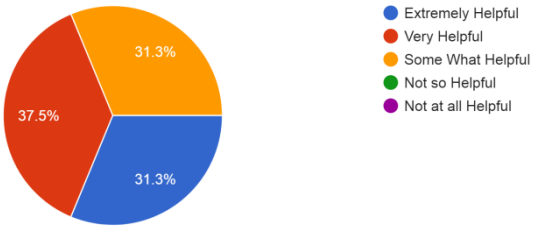

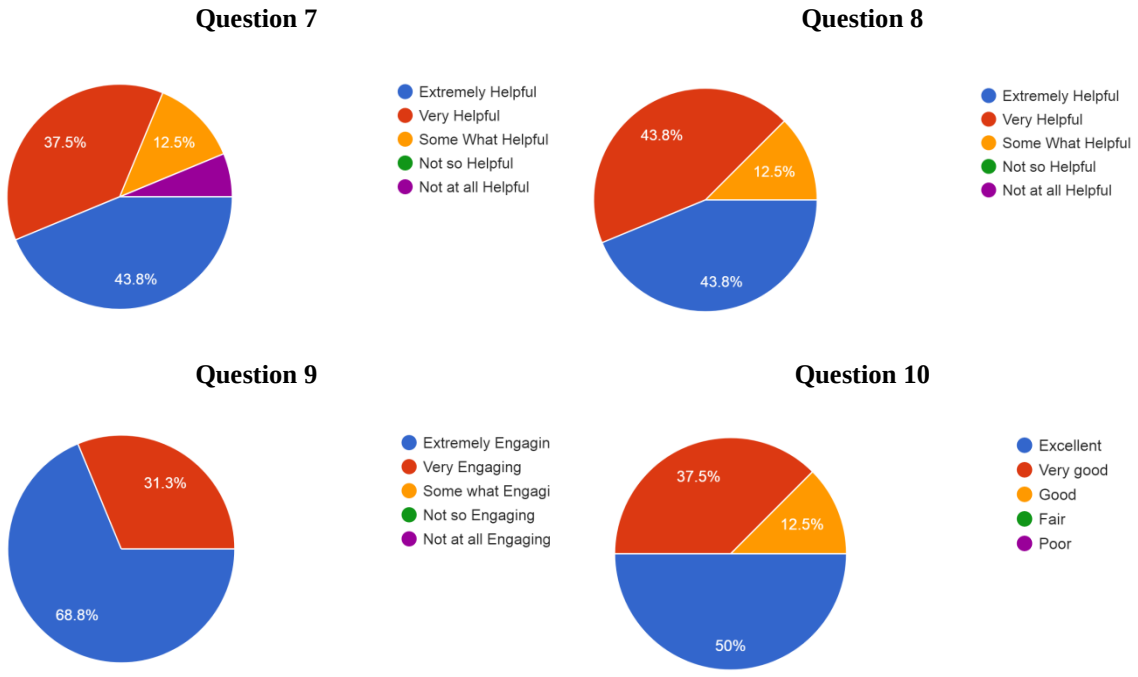

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