

A Proposed Framework for Integrating Interdisciplinary Approach in Undergraduate Architecture Design Education

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ABSTRACT

The twenty-first century is witnessing continuous developments and diverse challenges that cannot be understood from a disciplinary perspective alone. This prompted academia to pay attention to the interdisciplinary approach as an entry to acquire the skills needed to face these challenges by creating solutions exceeding the scope of one discipline. Accordingly, and in the context of keenness to apply this approach to the local architectural academia, the study aims to provide a proposed vision for integrating the interdisciplinary approach into architectural design (AD) education through the creation of the Interdisciplinary Architectural Design Studio (IADS), to be included in undergraduate curricula. Therefore, the study first relied on the inductive approach to analyzing the latest literature that recorded experiences about this topic, and examples from the current situation have operationalized this approach in the international and local architectural academia to understand various aspects related to this integration. Secondly, the deductive analytical approach, by surveying to investigate the relevance and effectiveness of applying this approach in AD teaching and mechanisms on which the proposed studio should be based. The study concluded by transforming lessons learned into a proposed framework that can be applied and tested, and that aims to link artistic, scientific, theoretical, and practical aspects and provide a learning environment that encourages building the century competencies.

KEYWORDS

Interdisciplinary education; Architectural design; Design studio; twenty-first-century competencies; Interdisciplinary design thinking.

1. INTRODUCTION

Independent disciplines are relied upon in all university colleges as platforms for imparting and generating knowledge (Repko, 2008), as they provide tremendous opportunities to gain depth in the field of discipline (Education Scotland, 2022). Today, as global challenges become increasingly complex (Li et al., 2015), many officials believe that discipline alone cannot address the challenges that graduates will face in their future lives, as work requires the ability to apply thinking from various fields (Education Scotland, 2022). Some agree that the basis on which the combination of some disciplines depends is the basic understanding of the discipline (Li et al., 2015). Where knowledge takes the shape of the letter T, the vertical part of the letter expresses depth in one field, while the horizontal bar represents the ability to cooperate across disciplines (Education Scotland, 2022).

Architecture is one of the most influential disciplines in our society and its development, as it affects the design, construction, and use of built environments (Khodeir & Nessim, 2020). Design is the cornerstone of architectural practice, so it forms the nucleus of architectural education. The Architectural Design Studio (ADS) represents the backbone of architectural education (Abusafieh, 2022; Yüksel & Uyaroğlu, 2021), which aims to develop creative thinking skills to prepare qualified designers (Abusafieh, 2022; Yocom et al., 2012) to practice the profession.

Despite ADS's pivotal role, there are shortcomings in this environment. W. Kumara et al. point out that many students in the studio find it difficult to come up with a meaningful concept and idea to initiate the design process (Kumara et al., 2019). According to Farahat, the ADS is primarily concerned with the artistic aspects of design, and this approach has led to a failure to confront the realities of professional practice (Khodeir & Nessim, 2020). Nicol and Pilling emphasize the inability of ADS to prepare qualified graduates with the teamwork and collaborative skills necessary for professional practice. They attribute this to that studios are oriented towards developing architects as individual designers (Ghonim, 2016), as well as the complete separation and lack of communication with other disciplines in the education system (Keenahan & McCrum, 2021). S. F. Abusafieh also explains that the studio is unable to enhance the cognitive abilities of most students with knowledge established for many years, as it tends to follow a teacher-centered approach that limits the ability of students to achieve a deep degree of understanding on their own (Abusafieh, 2022). In addition to not keeping pace with the needs of the twenty-first century and the continuous developments in architectural practice (Ghonim & Eweda, 2019).

Within the complexity of our contemporary world and the challenges facing the current ADS, it is crucial to rethink the goals of AD education and its environment to contribute to building twenty-first-century competencies to keep up with rapid developments.

1.1 Century Competencies: The Path to Develop University Education

The twenty-first century is characterized by rapid developments, and according to L. M. Khodeir et al., "continuous changes require incessant adapting to new situations and acquiring new skills to be successful." (Khodeir & Nessim, 2020, P.811). Recognizing this need, business, and educational leaders are demanding corresponding changes in education patterns to provide students with the knowledge and skills they will need for the changing world (The National Research Council, 2011). The U.S. National Innovation Initiative (NII) also called on educational institutions to change the way science and engineering are taught to reflect contemporary professional practices (Li et al., 2015). In the local context, the strategic goals of higher education in Egypt's Vision 2030 emphasize the necessity of improving the education system in line with global systems by empowering the learner with the requirements and skills of the twenty-first century (Sustainable Development Strategy - Egypt 2030, n.d.).

The requirements needed for the century are known as "21st-century competencies" to reflect the challenges of the century (Khodeir & Nessim, 2020). The term competence includes both knowledge and skills. According to the National Research Council's report (NRC), century competencies are acquired through a deeper learning process, which is defined as "the process through which a person becomes capable of taking what was learned in one situation and applying it to new situations." (The National Research Council, 2012, p. 1).

The NRC defined the most prominent conceptual frameworks for the century competencies, and the study adopts this model within its scientific framework, as it is more in-depth, and comprehensive. The NRC's competencies are classified into three main domains. Each includes a variety of secondary competencies (The National Research Council, 2012), (see Table 1), and together they constitute the competencies needed for twenty-first-century students.

Many studies have shown that one way to acquire these competencies is to support teaching methods with the interdisciplinary approach, which aims to expose students to various disciplines, encourage academic interaction, and conduct interdisciplinary projects (Khodeir & Nessim, 2020). In this context, one of the engineering education standards approved by the Accreditation Board for Engineering and Technology (ABET) states that engineering skills acquired during study should include the ability to work in interdisciplinary teams (Ali, 2019). In the local framework, higher education officials confirm that interdisciplinarity is one of the

most important axes of national strategy that outlines the features of higher education and scientific research and contributes to achieving Egypt's Vision 2030 (Saleh, 2023).

Table 1. Domains of twenty-first-century competencies by the NRC.

DOMAIN	CLUSTERS	TERMS USED FOR CENTURY SKILLS
COGNITIVE COMPETENCIES (thinking)	Knowledge	information literacy, ICT literacy, oral and written communication, active listening.
	Creativity	creativity and innovation.
	Cognitive processes and strategies	critical thinking, problem solving, analysis, reasoning/argumentation, interpretation, decision making, adaptive learning, executive function.
INTERPERSONAL COMPETENCIES (interacting with others)	Teamwork and collaboration	communication, collaboration, teamwork, cooperation, negotiation, conflict resolution, coordination, empathy/perspective-taking, interpersonal skills, trust, service orientation.
	Leadership	leadership, responsibility, assertive communication, self-presentation, social influence with others
INTRAPERSONAL COMPETENCIES (self-managing)	Intellectual openness	flexibility, adaptability, artistic and cultural appreciation, personal and social responsibility (including cultural awareness and competence), appreciation for diversity, continuous learning, intellectual interest and curiosity.
	Work ethic / conscientiousness	Initiative, self-direction, responsibility, perseverance, productivity, grit, type1 self-regulation (metacognitive skills, including forethought, performance, and self-reflection), professionalism/ethics, integrity, citizenship, career orientation.
	Positive core self-evaluation	type2 self-regulation (self-monitoring, self-evaluation, self-reinforcement), physical and psychological health.

Source: Adapted by Author from (Kyllonen, 2016).

1.2 Interdisciplinary Education: Concept and Effectiveness

In the context of trends that focus on the importance of “interdisciplinary education” to integrate knowledge between disciplines and reduce the boundaries between them (Helwan University Interdisciplinary Research Center, 2022). A.M. Badawi et al. explained that “interdisciplinary” “is an adjective that describes the interaction that occurs among two or more disciplines. Such interaction is broader than “multi-disciplinary” teamwork or collaboration, which are considered as one-discipline-based terms”(Badawi & Abdullah, 2021, p. 2). Diana Rhoten, et al. have defined the term (2006) as “a mode of curriculum design and instruction in which individual faculty or teams identify, evaluate, and integrate information, data, techniques, tools, perspectives, concepts, or theories from two or more disciplines or bodies of knowledge to advance students’ capacity to understand issues, address problems, and create new approaches and solutions that extend beyond the scope of a single discipline or area of instruction” (Repko, 2008, p. 14). This definition highlights that interdisciplinary education is based on exchanging concepts and ideas of two or more disciplines to find innovative solutions to address challenges, which provides the opportunity for students to expand their perspectives and enhance their skills and abilities.

In light of these concepts, many researchers and interested parties have revealed the feasibility of its application in education, and professional reality, (see Table 2). The study reviews its feasibility at the level of learners and skills acquired in another place.

1.3 Call for Interdisciplinary Architectural Design Education

Based on the complexity of our contemporary built environment, in light of recent trends that support interdisciplinary education, and architecture's vision as an interdisciplinary world (Abusafieh, 2022; Khodeir & Nessim, 2020), in terms of its essence and practice, several academic studies called for the urgent need to integrate the interdisciplinary approach into AD education due to the values it adds to this education (Ali, 2019).

In this context, A. Jutraz et al. state that “the knowledge of other disciplines is necessary for an architect to develop the quality of his/her architectural design” (Jutraz & Zupancic, 2014, p.35). The U.S. National Innovation Initiative’s (NII) report explains that “[innovation] arises from the intersections of different fields” (Li et al., 2015, p.2). Tucker & Abbasi point out that to overcome the limitations of individual work in ADS, interdisciplinary design must be adopted in educational methodologies (Ghonim, 2016). A.M. Badawi et al. reported that filling the education-to-professional practice gap requires graduating well-qualified students with teamwork and interdisciplinary skills (Badawi & Abdullah, 2021). The outlines of integrating this approach will be discussed in the subsequent parts.

Table 2. The feasibility of applying interdisciplinary education.

The Feasibility of Interdisciplinary Education	Scientific and Educational Field	Professional Reality
	<ul style="list-style-type: none"> •Filling the gaps in disciplinary-based educational programs, •Enhancing scientific strength and excellence in academic activities, •Promoting flexibility in educational systems and scientific research communities, •Enhancing the sense of novelty of topics among students and faculty members, •Contributing to solving real-world problems in innovative ways (Helwan University Interdisciplinary Research Center, 2022), •Upgrading the classroom experience and productive duties (Zwairi & Al-Qawasmi, 2019), •Increasing the quality of the learning process, •Enhancing sustainable learning outcomes (Abusafieh, 2022). 	<ul style="list-style-type: none"> •Removing barriers between theoretical knowledge (the university) and professional reality (Helwan University Interdisciplinary Research Center, 2022), •Preparing learners for the professional reality, thus responding to the necessary and changing needs of the labor market (Zwairi & Al-Qawasmi, 2019) (Helwan University Interdisciplinary Research Center, 2022).

Source: Mentioned beside each part.

2. OBJECTIVE / METHODOLOGY

With the growing interest and call for interdisciplinary architectural design education and in response to Egypt’s Vision 2030 for developing university education, the main objective of the study is to formulate a proposed strategy for integrating the interdisciplinary approach into AD teaching by creating IADS to be included within undergraduate courses in the local architectural academia. It contributes to developing the mechanism of AD teaching through the participation of many disciplines to link the artistic, scientific, theoretical, and practical aspects and provide a learning environment that encourages building the century competencies.

In the context of the intended goal, several questions were raised: What disciplines can participate in AD education? Are action mechanisms of the interdisciplinary studio similar to what is conducted in the main ADS? What is the added value of applying this approach? What are the challenges facing this educational model? Therefore, the study relied on two approaches to achieving its goal. First, the inductive approach to analyze examples of the latest empirical studies in this area. In addition to monitor and analyze examples that have operationalized this integration in international and local academia. This is to understand all dimensions related to research questions and benefit from them in preparing the proposed framework. Secondly, the deductive analytical approach represented by applying a closed questionnaire directed to a random sample of architects to investigate the relevance and effectiveness of applying this approach into AD teaching and mechanisms on which the proposed studio should be based. The study concluded by transforming two approaches findings into a proposed strategy that can be applied and tested.

The importance of the study lies in addressing one of the fundamental topics on the academic arena, which has a significant impact on both architectural education and practice. The study contributes to adding a new dimension to AD education and paves the way for applying this approach in the architectural academia, as the proposed ideas constitute a guide for academics.

3. INTERDISCIPLINARY ARCHITECTURAL DESIGN EDUCATION EXPERIENCES

Since the late 1980s, various attempts have been made to go beyond the approach used in AD education and envision a new educational environment based on linking it with different disciplines (Badawi & Abdullah, 2021). As the positive results of these attempts have emerged, efforts to support interdisciplinary design education have expanded to include both undergraduate and graduate levels in the United States and abroad (Li et al., 2015) to date. As a result of these efforts, a wealth of empirical studies on AD teaching using an interdisciplinary approach has been generated and accumulated.

Preparing interdisciplinary architectural design courses represents a major challenge for decision-makers in academic institutions, which requires studying many previous experiences for guidance. Therefore, this section aims to answer the research methodology questions to form a comprehensive picture of this topic to benefit from it in formulating the proposed framework.

Despite the abundance of studies that applied this concept, a sample of them has been included, which was limited to the most recent studies related to the undergraduate level. This resulted in the inclusion of five studies representing different educational cultures.

3.1 Mechanisms of Action

In this part, the selected studies were analyzed to answer some research questions: What disciplines can participate in AD education? Are action mechanisms of the interdisciplinary studio similar to what is conducted in the main ADS? These questions aim to reveal the mechanisms and plans of action that were followed in conducting these experiments, (see Table 3). The findings will be discussed after monitoring and analyzing action mechanisms related to studying examples that have been operationalized in architectural academia to discover more mechanisms.

3.2 Added Values for Students

Interdisciplinary experiences tend to be highly motivating. Therefore, many researchers point out that the impact of these experiences outweighs expected perceptions on both learners and participants (Education Scotland, 2022). From this standpoint, the teaching and learning environments were evaluated during the experiment or after its completion through direct observation during the experiment, reviewing student performance reports, interviews, discussions, and online post-experiment questionnaires, to survey students' opinions about the effectiveness and impact of these experiences on their design abilities, knowledge, and skills.

In this part, the feasibility and effectiveness of integrating the interdisciplinary approach were analyzed to identify added value and acquired skills in light of century competencies, (see Table 4). Since the analyzed studies did not address many of the terms of century competencies directly, the results were studied, and some acquired skills that were not clearly mentioned were extracted.

Table 4 revealed the competencies that students acquired from interdisciplinary design education that are necessary for the century. The added value relates to two main aspects. First, the mental competencies that enhance creativity necessary for design (cognitive). Second, interpersonal competencies that focus on the practical aspect and teamwork. Despite the importance of intrapersonal competence for students, as it greatly affects their performance, literature has not addressed it adequately, which requires conducting more research.

The most important cognitive skills lie in realizing the relationship between disciplines and breadth of knowledge about various disciplines. Understanding the process of interdisciplinary design, stimulating imaginative and creative ability in design, creating new designs based on integrating disciplinary ideas, and therefore, developing ability and

competence in design (Badawi & Abdullah, 2021). As well as improving analytical and critical thinking skills based on interdisciplinary interaction (Abusafieh, 2022).

Table 3. Action mechanisms of interdisciplinary design education experiments.

Paper	1- (Abusafieh, 2022)	2- (Yüksel & Uyaroğlu, 2021)	3- (Kumara et al., 2019)	4- (Chianeh et al., 2020)	5- (Badawi & Abdullah, 2021)
Integrated disciplines	Music	Performance Arts (modern dance)	Poetry	Mathematics (mathematical thought)	Structural, Electrical, and Mechanical Eng.
Integration Motives	<ul style="list-style-type: none"> Their close relationship, both are branches of art. Its influential role in stimulating human imagination. 	<ul style="list-style-type: none"> The dynamic capacity of both body and space. 	<ul style="list-style-type: none"> Their close relationship, both are forms of art. Its important role, as a source of inspiration to start the design process. 	<ul style="list-style-type: none"> Their close and traditional relationship. Its prominent role in AD teaching and developing creative thinking skills. 	<ul style="list-style-type: none"> The real practice of designing and implementing buildings depends on collaboration between these disciplines.
Studio objectives	<ul style="list-style-type: none"> Learning 3 basic design principles associated with the two disciplines: harmony, repetition, and rhythm. 	<ul style="list-style-type: none"> Understanding the relationship between body and space through spontaneous bodily experiences via space and reproducing it in the conceive of space. 	<ul style="list-style-type: none"> Understanding and developing the student's ability to derive an abstract concept from poems and transform it into an architectural space. 	<ul style="list-style-type: none"> Developing students' ability to use mathematical knowledge and thinking in the AD process. 	<ul style="list-style-type: none"> Understanding of the integrated and interdisciplinary design process. Working within an interdisciplinary team and creating an interdisciplinary design.
Nature of the course	Basic Design Studio	Basic Design Studio		Basic Design Studio 1 Basic Design Studio 2	
	Elective				Interdisciplinary Design Course (IDC)
Undergraduate level	Y. 1	S.1			
	Y. 1	S.2			
	Y. 2	S.1			
	Y. 2	S.2			
	Y. 3	S.1			
	Y. 3	S.2			
	Y. 4	S.1			
	Y. 4	S.2			
The nature of work	Individual				
	Teamwork	Group of three			Each team has 3 ARCH, 1 STR, 1 MECH, and 1 ELEC
Teaching participants	Studio Instructors	Studio Instructors + Performance Artist and Dancer (architect)	Studio Instructors	Studio Instructors + Two experienced mathematics professors	Four instructors (ARCH, STR, MECH, and ELEC)
Design Project Approach	Studio-based design project	Studio-based design project	Studio-based design project	Studio-based design project	Project based on real circumstances, with the use of BIM

Source: Mentioned above each part.

Collaborative experiments in the interdisciplinary environment contributed to the acquisition of many interpersonal skills related to building a team culture, including the ability to work in a collaborative environment, enhancing communication and interaction skills with a group of diverse disciplinary backgrounds, improving the ability to exchange ideas and experiences, developing collaborative design thinking and creativity, participating effectively in all stages of design, and increasing awareness of how to resolve conflicts and clashes between disciplines (Badawi & Abdullah, 2021; Yüksel & Uyaroğlu, 2021).

Many of the above-mentioned skills promoted the acquisition of many intrapersonal skills, such as cognitive and intellectual flexibility, adapting and adjusting to different

situations, appreciation of diversity, intellectual interest and curiosity to learn and know, and developing a sense of responsibility and productivity.

The added values discussed confirm that interdisciplinary design education provides an effective educational environment that encourages the acquisition of the knowledge and creative and collaborative skills needed for this century.

Table 4. Added value and skills acquired from interdisciplinary design education.

		COGNITIVE										INTERPERSONAL										INTRAPERSONAL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		Knowledge skills		Creativity skills		Cognitive processes and strategies skills						Teamwork and collaboration skills				Leadership skills		Intellectual openness skills				Work ethics / conscientiousness skills				Positive core self-evaluation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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Source: Mentioned beside each part.

3.3 Challenges Faced in The Experiments

During the feasibility evaluation process of experiments, feedback was also collected about the challenges encountered in experiments. Due to the shortcomings of some literature under study in discussing challenges, one of the specialized literatures in examining these challenges was added.

In this part, challenges monitored by the analysis were reviewed, (see Table 5), with the aim of providing some suggestions that may contribute to avoiding such challenges.

Table 5. Challenges faced in interdisciplinary design education experiments.

Challenges faced in interdisciplinary architectural design education	HUMAN CHALLENGES		REGULATORY CHALLENGES
	Related to students	Related to teaching staff	
	<ul style="list-style-type: none"> Difficulty dealing with concepts they have never studied before and how to use them to solve design problems (Yüksel & Uyaroglu, 2021; Chianeh et al., 2020), Poor communication and interaction with some team members from other disciplines, which led to making design decisions related to the work of these disciplines (Badawi & Abdullah, 2021), Confusion due to conflicting comments and different ways of thinking about design, and feeling frustrated by the varying opinions while appreciating design work from instructors of different disciplines (Li et al., 2015). 	<ul style="list-style-type: none"> Faculty lack consensus on the concept of interdisciplinary team teaching, as some tend to teach basic design aspects through the lens of their specialized fields (Li et al., 2015), Subjective considerations of instructors in different disciplines in appreciation and evaluation procedures (Abusafieh, 2022), Weak educational follow-up by some instructors, which causes poor technical knowledge of the students (Badawi & Abdullah, 2021). 	<ul style="list-style-type: none"> The timing of the elective course conflicted with the mandatory academic schedules and with the period of the capstone project, which affected the performance and participation of students, Difficulty in evaluating individual student performance within the team, Ignoring the role of non-architectural disciplines in the early stages of design due to the dominant role of the architectural discipline in the schematic design stage and the large size of the project (Badawi & Abdullah, 2021).

Source: Mentioned beside each part.

It is noted from Table 5 that most of the human challenges faced by this education are common in ADSs, apart from being interdisciplinary. These challenges may result from

differences in personal factors for both parties (teaching staff and students), which affect communication and interaction with others and the students' learning and development.

Although human challenges are individual and not related to the targeted vision of the study, avoiding such challenges first requires more concerted efforts among faculty members from different disciplines and holding many discussions to agree on all details and implementation mechanisms of the course. The most important of these are the evaluation criteria and the principles of teaching interdisciplinary design, how to introduce common themes to achieve the fusion of disciplinary perspectives rather than presenting them through the lens of their disciplines. Secondly, follow up and support students to develop design thinking skills and enhance their creativity by clarifying how to integrate and transform various disciplinary concepts, theories, and ideas into innovative designs.

Regarding regulatory challenges, some recommendations that may contribute to avoiding them are presented within the proposed methodology, but without addressing performance evaluation in the interdisciplinary design education environment and the criteria it includes, as it is a complex issue that requires more in-depth and targeted research, which falls outside the scope of this study.

4. STATUS QUO OF INTERDISCIPLINARY ARCHITECTURAL DESIGN EDUCATION

In light of repeated calls to incorporate this approach, many efforts have been made to support this concept in international and local architectural academia. Therefore, this section aims to monitor and analyze some of these efforts to explore more action mechanisms for this integration.

In this context, the study used an internet-based tool to collect information published on the official websites of architectural programs at international and local universities (in study plans, course descriptions, and course outlines) about courses that have operationalized this approach in their curricula. While visiting the relevant websites, their various designs caused a long-time consumption in finding the required information. Several courses were also excluded due to lack of required information. Finally, courses that provided the necessary information and allowed a variety of integrated disciplines and teaching strategies were studied. But without evaluating their effectiveness or the challenges they faced due to not being mentioned on the official websites.

4.1 International Interdisciplinary Architectural Design Courses

Globally, many architectural entities have taken steps towards operationalizing this approach at two levels within their educational systems. At one level, some architecture schools have launched interdisciplinary programs, whether at the undergraduate or postgraduate level, which, although similar to the framework of study, fall outside its scope. On another level, interdisciplinary architectural design studios have been operationalized within undergraduate programs, which the study focuses on analyzing.

In this context, realistic models of international interdisciplinary studios were analyzed to cover a variety of integrated disciplines and teaching strategies, (see Table 6).

4.2 Local Interdisciplinary Architectural Design Courses

At the local level, the interdisciplinary approach is the most important axis of the national strategy for higher education that contributes to achieving Egypt's Vision 2030 (Saleh, 2023). Examination of the official websites of several local universities revealed their application of this concept and the availability of a set of interdisciplinary courses at the undergraduate level. However, the study was limited to analyzing the interdisciplinary studio of the architectural programs at the Faculty of Engineering, Ain Shams University, due to the

availability and ease of access to information about this course in addition to its use of multiple teaching strategies.

The Architectural Engineering, and Environmental Architecture and Urbanism programs at the Faculty of Engineering, Ain Shams University launched the World Design Studio (WDS) (Faculty of Engineering, n.d.), the first step towards interdisciplinarity, in 2017, within the framework of the integration of the university's plan with Egypt's vision. Table 6 shows the WDS mechanisms.

Table 6. Action mechanisms of interdisciplinary design studios in architectural academia.

Organized educational Institution		INTERNATIONAL EFFORTS				LOCAL EFFORTS	
		Faculty of Art, Design and Architecture, Monash University, Melbourne, Australia (Faculty of Art, Design and Architecture, 2023a, 2023b, 2023c).	College of Architecture & the Built Environment, Thomas Jefferson University, Pennsylvania (IDEAStudio, n.d.) (Connery et al., 2020)	The architecture and the landscape architecture departments, College of Arts and Architecture, + the architectural engineering department, College of Engineering, the Pennsylvania State University, U.S.	School of architecture, Princeton University, New Jersey, U.S. + São Paulo's Faculty of Architecture and Urbanism (FAU) in Brazil (Coursicle, n.d.; High Meadows Environmental Institute, n.d.; Office of the Registrar, 2018)	Faculty of engineering, Ain Shams university, Egypt, Landscape architecture program, school of architecture, Clemson university, U.S., and Department of architecture, & department of landscape architecture, Huazhong Agricultural university, China	
Nature of the course	Elective	Interdisciplinary Studio 1 (ADA 2001) Interdisciplinary Studio 2 (ADA 3001) Interdisciplinary Studio 3 (ADA 4001)		Co-Lab - Interdisciplinary Collaborative BIM Studio (PennState College of Arts and Architecture, 2019; Irwin, 2023; University of Florida - College of Design, Construction and Planning, 2017; Scussel, 2010).		WDS - World Design Studio (Faculty of Engineering, n.d.)	
	Compulsory		Interdisciplinary Design and Experimental Architecture Studio (IDEA).		Interdisciplinary Design Studio - (ARC 205)		
Integrated disciplines		Art, Design & Architecture.	Emerging materials & technology Architecture.	Architecture, Landscape arch., Const. management, Structural, Mechanical & Electrical Eng.	Architectural & Urban design.	Architectural, Urban, and Environmental Design, Urban Planning, & Landscape.	
Undergraduate level	Y1	outside of semesters 1 and 2					
	S.1						
	S.2						
	Y2						
	S.1						
	S.2				OR		
Y3	S.1						
	S.2						
	S.1						
Y4	S.1						
	S.2			Engineering disciplines			
Y5	S.1		ARCH 507-Design 9				
	S.2		ARCH 508-Design 10	Arch. & Landscape arch.			
The nature of work	Teamwork	Teams each include representatives of the participating disciplines.	Teams of architecture students	Teams each include representatives of the participating disciplines.	Teams of architecture students	Teams each include representatives of the participating disciplines and continents.	
	Individual						
Teaching participants		Academics from participating disciplines	Academics and local, national, and international experts from diverse fields (textile design, structural engineering, industrial design, etc.).	A team of academics, a project team (design practitioners and contractors), and professional consultants (Penn State alums).	A team of academics across disciplines (design, urbanism, environmental science, the humanities, computer science, and engineering).	Academics from participating disciplines and cultures, government representatives, and specialists in participating fields.	
Project Approach		Live projects: Special or one-off project opportunities.	Projects range from products to building and urban scales.	Design-build real-world projects using BIM.	Studio-based design project: four projects over the span of the semester	Live projects at the national and international levels.	

Learning Outcomes / Objectives	<ul style="list-style-type: none"> • Conceptualize, innovate, and design creative solutions for real-world, multi-faceted problems by applying knowledge and methodologies from various disciplines. • Develop communication skills and operate collaboratively. • Contribute as a discipline-specific practitioner within an interdisciplinary team. 	<ul style="list-style-type: none"> • Participate in the advancement of knowledge by linking research and practice with education and design thinking with the sciences to tackle rapid changes affecting the built environment. • Gain interdisciplinary communication and interaction skills and collaborate with others. 	<ul style="list-style-type: none"> • Understand the technical, aesthetic, and social aspects of the integrated collaborative design process for AEC projects. • Gain interdisciplinary communication and collaboration skills to achieve a common goal. • Use BIM technology to experience first-hand interdisciplinary design approach and analyze and develop building designs. 	<ul style="list-style-type: none"> • Understand the multiple forces that shape design thinking. • Build design and critical thinking skills from an interdisciplinary perspective. 	<ul style="list-style-type: none"> • Strengthen cultural relations and exchange knowledge, skills, and experiences through interactive cross-cultural learning settings. • Enhance the quality of architectural education and enrich university programs. • Benefit from international expertise in providing solutions for the problems.
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Source: Mentioned above each part.

Qualitative data analysis in Tables 3 and 6 showed the multiplicity, diversity, and difference of disciplines that have been integrated into AD education, including artistic disciplines, scientific disciplines such as mathematics, and many diverse engineering disciplines, in addition to various architectural disciplines. This finding confirms Vitruvius' vision of architecture as "a harmonious combination of artistic sensibility and scientific science" (Abusafieh, 2022, p.641) and reveals the extent to which these disciplines are intertwined with architectural discipline.

In response to the second question of the study related to the extent of similarity of the work mechanisms in both the interdisciplinary studios and the main ADS. The action mechanisms and strategies of the interdisciplinary studios at experimental and applied levels revealed that although they are built on a common foundation with the main studio, it differs in its objectives and application in terms of the work environment, the design project approach, and the participants in teaching the courses. This difference is due to the involvement of disciplines in AD education.

At the same time, the analyses also highlighted the non-conformity of action mechanisms at experimental or applied levels, as each interdisciplinary studio adopted tools based on the nature of the integrated discipline. The methods of design thinking and work environments within the studio have varied between individual work and teamwork allowing collaboration with a team from the same discipline or different disciplines to simulate architectural work environments. Also, these studios have adopted a variety of design project approaches, which include studio-based design projects, design and construction projects with real challenges, and participation in national projects aimed at proposing design solutions to existing problems. As for those in charge of teaching these studios, it became clear that it was not limited to architectural academics but was joined by an elite group of academics, experts, and consultants from participating disciplines.

Several interdisciplinary studios were conducted over one semester. Although this period is suitable for the early stages, it requires more time in the final stages to create a comfortable work environment, get the best results, and master various skills.

This approach has been applied in different ways. Many academics included it in mandatory studios, while some have created elective courses, except that they have faced some challenges related to the incompatibility of their timing with mandatory courses (see Table 5).

5. INVESTIGATE THE APPLICATION OF INTERDISCIPLINARY AD EDUCATION

Based on the above analyses, it has become clear the importance of the interdisciplinary approach's role in AD education and the acquisition of century skills. It is also evident that there is an increasing need to integrate this approach into AD education. Therefore, this section verifies, through the application of a questionnaire, the validity of many issues related to this matter to formulate the proposed vision. This section documents the survey procedures.

5.1. Survey Methodology Design

This survey aims to investigate the relevance and effectiveness of applying the interdisciplinary approach to AD education and the mechanisms on which it should be based, which were derived from the above analysis, where it forms the basis of the proposed vision.

Given the relevance of the study field to the integration of the interdisciplinary approach in AD education, the study population has been based on surveying opinions of directly relevant parties and those with practical experience in dealing with many disciplines during different design stages of the project, which is focused on professional architects of the profession, both architectural practitioners and academics, to enhance diversity and ensure comprehensiveness of results. Due to the breadth of this community to include all architects, a simple random sample of the target community was examined.

The tool used to collect data was an electronic questionnaire, prepared online using Google Forms. After conducting a pilot study to examine the clarity of questions and the length of the questionnaire, improvements were made based on comments received. The pilot responses confirmed the practical nature and importance of the study topic. Then it was distributed by sending the survey link via social media to respond to the survey.

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The questionnaire focused on quantitative analysis by using closed-ended questions, including multiple-choice and checkbox questions, to reach measurable results and determine consensus and disagreement among respondents. Many MCQs used a five-point Likert scale to measure the nuances of opinions and the degree of agreement on ideas presented. Options of answers provided in the survey were based on an in-depth analysis of the various issues outlined in the first part of the study, with the answer option “other” added to explore new answers.

The questionnaire began with an introductory paragraph indicating the subject of the study, then asked about respondents’ personal information. It was divided into three parts. The first part included five questions related to revealing respondents’ practical experience in dealing with different disciplines and the extent of its impact on their skills acquisition. The second part contained three questions about the concept of interdisciplinary architectural design education and its effectiveness in many aspects of the educational process. The last part was devoted to questions (6) related to the proposed vision, to determine the extent of the importance and necessity of integrating this approach into AD education and to reveal the most important working mechanisms on which interdisciplinary architectural design education should be based.

5.2. Respondents’ Profiles

The questionnaire was directed at the targeted sample; 83 responses were received for a rate of approximately 53.5%. Collecting responses took a long time. This number was considered sufficient for the study purpose. Many architects apologized for not participating, while others responded and reported that they forwarded it to others who might be interested in

contributing. Many respondents expressed their appreciation for the research topic, provided positive comments after completing the survey, and assured that the topic was interesting. This part aimed to analyze the characteristics of the respondents' sample, which are as follows:

- The respondents' work fields: the sample included various functional competencies; the category most participating was architectural designers and office engineers (see Fig. 1). As is clear from the numbers and percentages in the chart, many respondents combine more than one field.
- The respondents' practical experience: participants' years of experience varied; the category "less than 10 years" accounted for the largest percentage, reaching more than half, while the percentages of more experienced participating categories were largely balanced, (see Fig. 2). It is clear from the analysis of the respondents' profiles that the participants have diverse skills and experiences, which contributes to broadening the perspectives related to study.

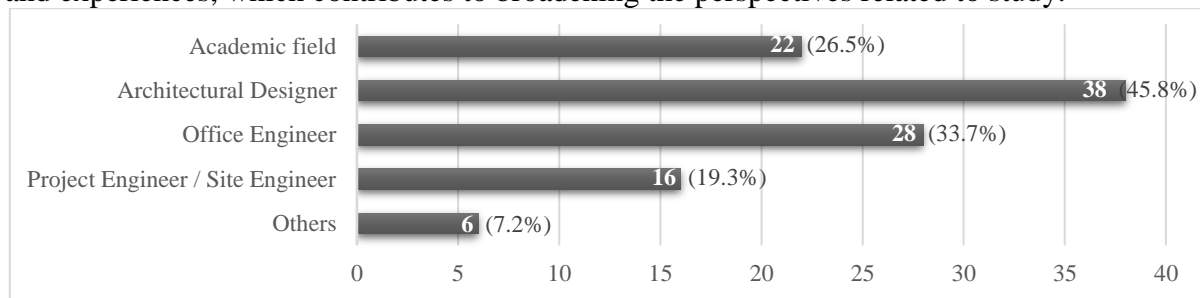


Fig. 1: Respondents' work fields.

Source: Author.

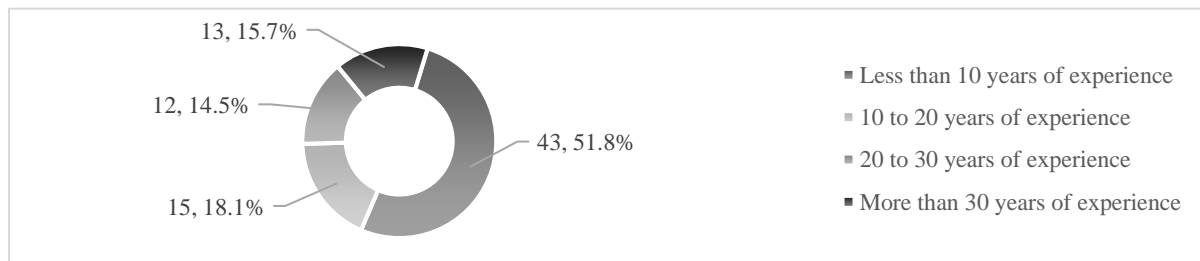


Fig. 2: Respondents' years of work experience.

Source: Author.

5.3. Analysis And Discussion of Survey Results

This part provides an analysis of responses and a discussion of results. The survey focuses on quantitative results to make more rational decisions regarding the proposed vision using objective data and analysis rather than relying on subjective decisions. During the discussion, some qualitative and quantitative results were compared to determine the extent of agreement and disagreement regarding several issues under study. The results were divided into three themes:

5.3.1. Theme 1: practical experience in collaboration with various disciplines

The various questions aim to reveal the respondents' experience in collaborating with different disciplines and to measure and identify the acquired skills and competencies.

Responses related to this experience indicated that ($n = 81$, 97.6%) of participating architects collaborated with several disciplines during the project design stages. Fig. 3 showed the various disciplines that respondents dealt with. Fig. 4 clarified the design stages in which collaboration has been made with these disciplines. Some respondents added other disciplines and stages, but they are related to the implementation stage, which falls outside the study scope. It appears from these analyses that questions have supported the possibility of choosing more than one option.

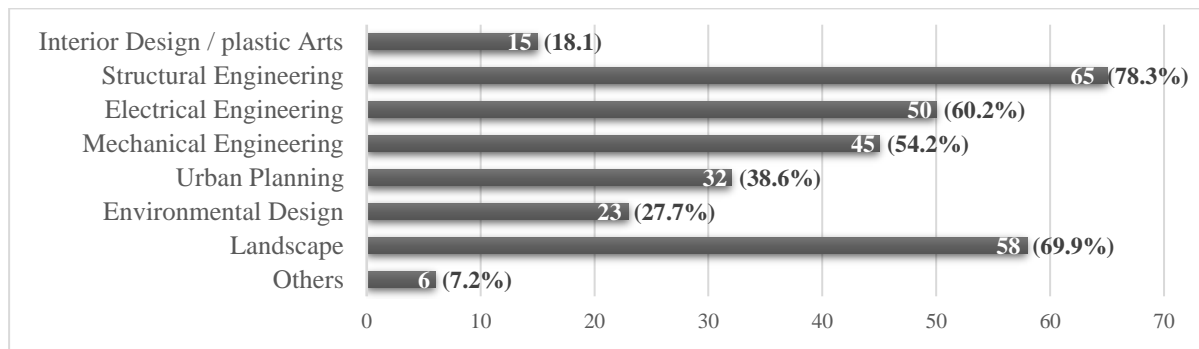


Fig. 3: The various disciplines that the sample collaborated with during design stages.

Source: Author.

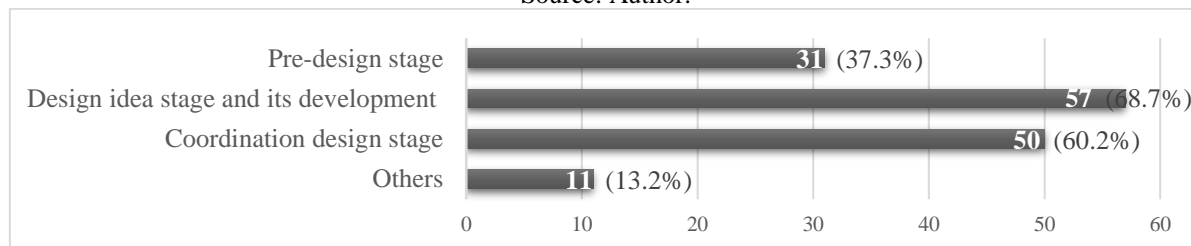


Fig. 4: Architectural design stages in which the sample dealt with various disciplines.

Source: Author.

The results revealed that, regardless of the higher percentages related to various disciplines or design stages, collaboration with various disciplines is an essential part of the design process in all its stages. This supports the qualitative findings that the complexity of design makes it challenging for an architect to provide solutions to all design aspects.

As for the question about skills acquired, given the abundance and diversity of century skills, the question included some related to study. The responses showed that 97.6%, or 81 individuals from the sample, acquired new skills from this collaboration. This percentage is consistent with the percentage who dealt with various disciplines. This finding confirms that collaboration with different disciplines contributes to the acquisition of new skills. Fig. 5 reveals the diversity of skills acquired, with the highest percentages for analysis, decision-making and problem-solving, teamwork/dealing with different cultures, communication and collaboration during problem solving, flexibility and adaptability, and extensive knowledge skills, reaching (73.5%), (71.1%), (71.1%), (68.7%), and (67.5%), respectively. All acquired skills are considered essential skills for the century. This result supports and complements what was reached in the previous qualitative results, as it identified the most important acquired skills from this interaction.

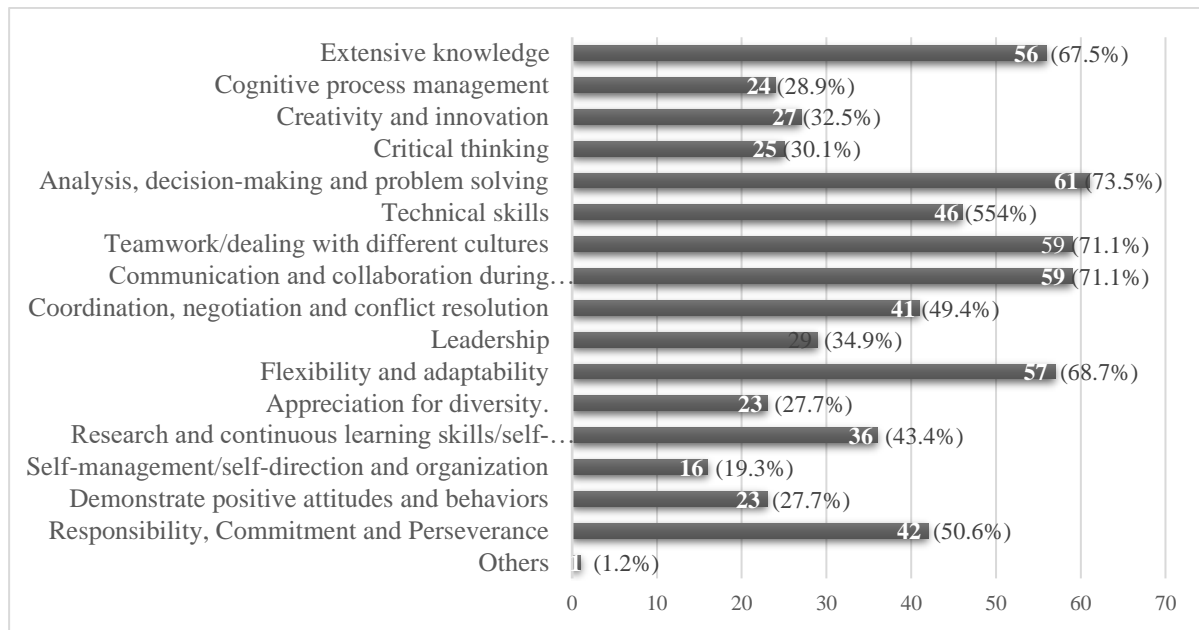


Fig. 5: Skills acquired by the sample through work with various disciplines and fields.

Source: Author.

5.3.2. Theme 2: Understanding and effectiveness of the targeted concept

This theme aimed to reveal respondents' understanding of the term interdisciplinary architectural design education and their envisioning of the extent of its impact on some educational aspects.

The responses indicated that ($n = 53$, 63.9%) had prior knowledge of the target concept. Although this percentage is not large, during the verification of understanding of the term, it rose to 91.6%, as many of those who had no prior knowledge tried to define this concept. Fig. 6. showed that nearly half of the respondents participated in understanding the ostensible and general meaning of the term, but only ($n = 34$, 40.96%) were fully aware, and they determined its exact and esoteric meaning. A small number of respondents, 7 (8.43%), expressed their lack of understanding through the option "other."

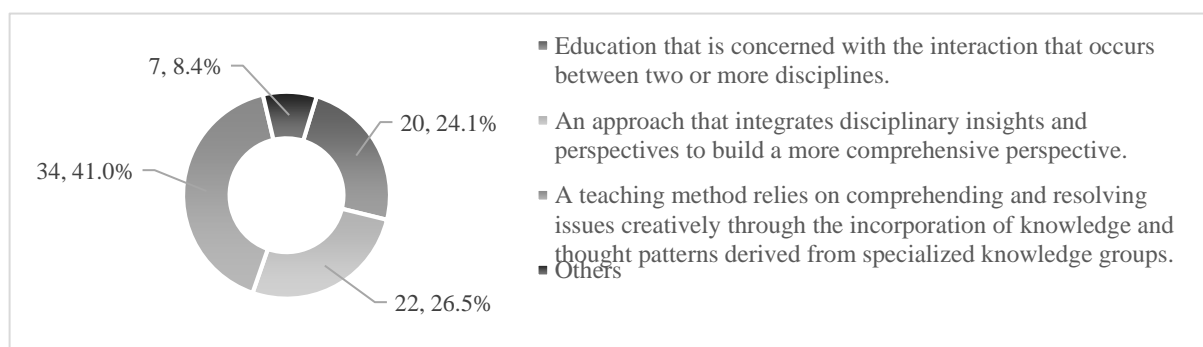


Fig. 6: Indicators of understanding of interdisciplinary AD education term.

Source: Author.

The last question of this theme examined the extent of the impact of this approach on some parties of the educational process. Question options were formatted in a five-point Likert scale. Table 7 shows phrases and options used and illustrates the responses' details and results.

Table 7. Respondents' ratings for the impact of the target concept on some aspects of the educational process.

	The Phrase	Responses	No effect	Weak	Medium	Strong	V. strong	Mean	Result
1	Improving the design learning process.	Frequency	2	3	20	46	12	3.8	Strong
		Percent (%)	2.4%	3.6%	24.1%	55.4%	14.5%		
2	Pushing architectural creativity (learning outcomes) to new horizons.	Frequency	1	2	33	36	11	3.7	Strong
		Percent (%)	1.2%	2.4%	39.8%	43.3%	13.3%		
3	Expanding a student's horizons, stimulating his creative imagination, and enhancing his design capabilities.	Frequency	2	6	30	30	15	3.6	Strong
		Percent (%)	2.4%	7.2%	36.15%	36.15%	18.1%		
4	Improving the students' cognitive and intellectual skills and building competencies.	Frequency	2	2	25	38	16	3.8	Strong
		Percent (%)	2.4%	2.4%	30.1%	45.8%	19.3%		
5	Addressing the complex and multifaceted challenges posed by contemporary design.	Frequency	2	1	27	33	20	3.8	Strong
		Percent (%)	2.4%	1.2%	32.5%	39.8%	24.1%		
6	Graduating suitably qualified students for the responsibilities that await them in fields of work.	Frequency	2	2	20	40	19	3.9	Strong
		Percent (%)	2.4%	2.4%	24.1%	48.2%	22.9%		

Source: Author.

The Likert scale analysis in Table 7 indicated that mean responses to various phrases ranged from (3.6) to (3.9), which corresponds to "strong". This finding demonstrated that the study sample, with its experience in this regard, confirmed that this type of education has a strong impact on the design learning process, learning outcomes, and students' skills and abilities, consequently on architectural graduates, in addition to its impact in facing contemporary challenges. It is also clear that despite the closeness of the arithmetic means of all phrases and the absence of significant differences, the highest evaluation was for its impact on qualifying the graduate with knowledge and skills to suit different fields of work.

5.3.3. Theme 3: Explore prospects of integrating the targeted approach into AD teaching

This theme aims to explore the respondents' opinions on the necessity of integrating the interdisciplinary approach into AD education and the work mechanisms on which the management of this integration can be based to contribute to the proposed vision formulation.

The pie chart in Fig. 7. revealed the support of responses and their mean value (4.22), which represents "very important," for the relevance and necessity of adopting the integration of the interdisciplinary approach in AD teaching.

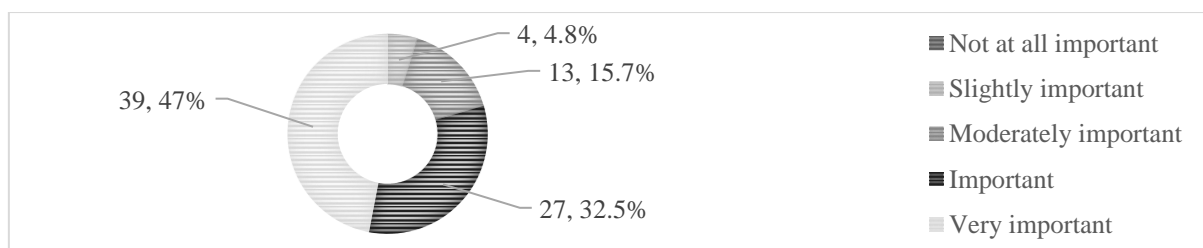


Fig. 7: Opinions on the necessity of integrating the target approach into AD teaching.

Source: Author.

Respondents were then asked to choose the most effective way to apply this integration, and the answers covered 3 options in addition to the option "other". Fig. 8 shows that most responses (n= 63, 75.9%) support its application through the studio separate from the main studio, confirming their awareness of its different role. Besides, the option as a compulsory

studio (n = 34) dominated the other option as an elective studio. This finding contributes to overcoming incompatibility in the timing of elective and compulsory courses and achieving the benefit to all students.

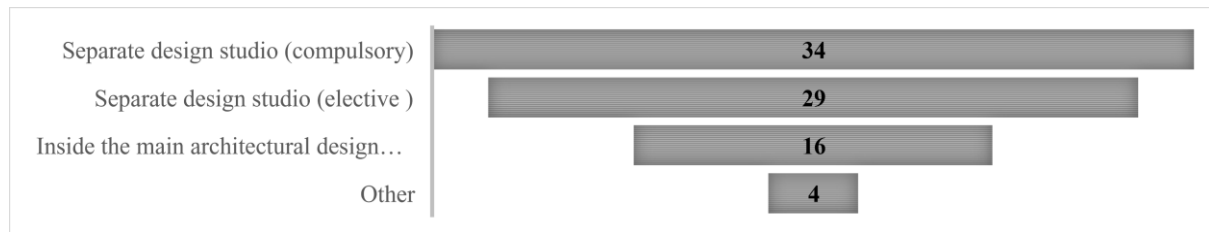


Fig. 8: Sample preferences for how to apply interdisciplinary AD education.
Source: Author.

In the context of determining the most appropriate disciplines that can participate in AD teaching, the sample was asked about the extent to which a range of disciplines would influence AD learning and acquiring diverse competencies. The questions covered all disciplines that were extracted from the above inductive analyses. The options for these questions were formulated on a five-point Likert scale. Table 8 shows the options used and the details and results of responses.

Analysis of Likert scale averages in Table 8 showed a diversity in values of the effect of a group of disciplines on dependent variables referred to above. It is clear from the high mean values that the integration of related disciplines will be effective and bring about a strong positive change in improving the learning of AD and acquiring skills. While the lowest value indicates that the integration of artistic disciplines makes actual change to dependent variables, but the expected magnitude of change is of medium effectiveness. Despite ratings differing, they emphasized that the study sample, with its experience in the AD process that involves a wide range of artistic and technical considerations, supported the integration of these disciplines into AD education.

Table 8. Respondents' ratings on the impact of a range of disciplines on AD education.

	The questions	Responses	No effect	Weak	Medium	Strong	V. strong	Mean	Result
1	Does the integration of some artistic disciplines have an impact on improving the AD learning process and stimulating the student's imaginative ability?	Frequency	12	13	28	16	14	3.1	Medium
		Percent (%)	14.5%	15.7%	33.7%	19.3%	16.9%		
2	Does the inclusion of teaching mathematics, specifically geometric shapes, have an impact on learning architectural design and enhancing creative ideas?	Frequency	3	2	13	30	35	4.1	Strong
		Percent (%)	3.6%	2.4%	15.7%	36.1%	42.2%		
3	Does the combination of engineering disciplines (structural, mechanical, etc.) have an impact on understanding the integrated design process, seeing design problems, and finding solutions to them?	Frequency	0	0	12	15	56	4.5	Very Strong
		Percent (%)	0%	0%	14.5%	18.1%	67.5%		
4	Does collaboration with different architectural disciplines (landscape, urban planning, etc.) have an impact on understanding the multiple forces that shape design	Frequency	0	1	7	15	60	4.6	Very Strong
		Percent (%)	0%	1.2%	8.4%	18.1%	72.3%		

thinking and how to link different design requirements?									
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Source: Author.

Another issue related to work methods (individual/teamwork) that should be followed in interdisciplinary design education was also investigated. Question options were formulated on a five-point Likert scale. Fig. 9 and mean responses on the scale (4.15) representing “agree” revealed respondents’ support for employing various methods in this education as it contributes to combining individual and team design skills, which confirms their awareness that the AD process requires a balance between two methods. More than half of respondents (n=47, 56.6%) confirmed that the use of these methods depends on the disciplines that participate in teaching.

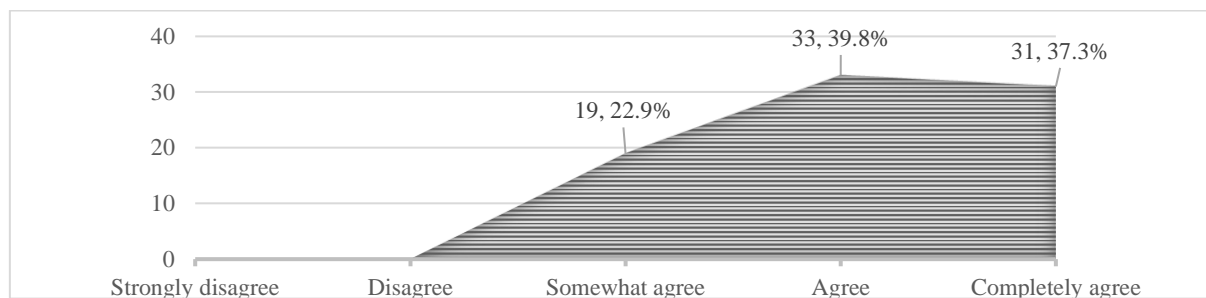


Fig. 9: Opinions of the study sample on the role of diverse work styles in acquiring skills.

Source: Author.

Responses about the participants in teaching interdisciplinary architectural design, (see Fig. 10), and the average values of these results (4.47) and (4.45) showed a noticeable agreement on the very strong positive impact of hiring non-academic experiences on students’ thinking and enhancing their cognitive and design skills. The experiences supported by the sample lie in hosting an elite group of experts and consultants from the participating disciplines and enhancing collaboration with graduates who have obtained important architectural jobs to involve them in interdisciplinary teaching to share their extensive knowledge and experience with the students.

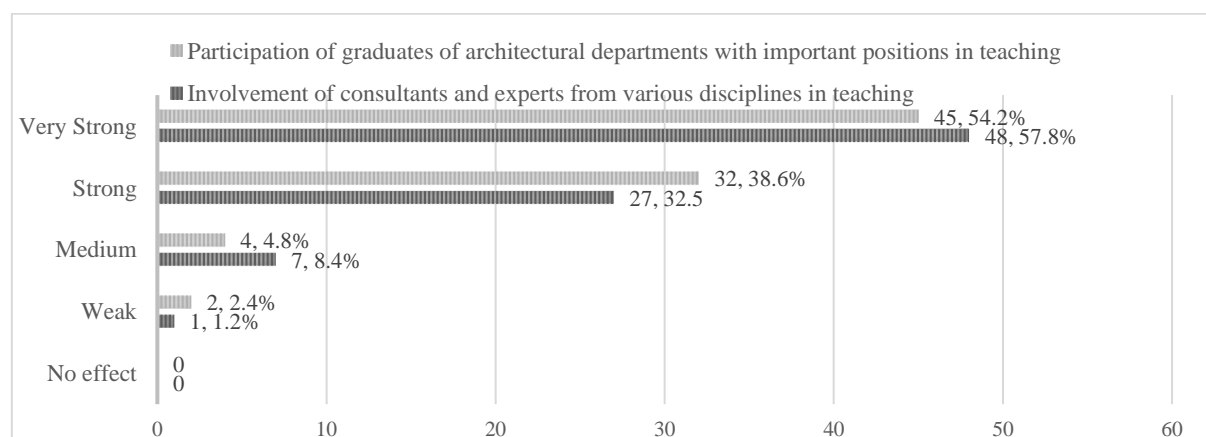


Fig. 10: Opinions on the involvement of non-academic experts in IADS teaching.

Source: Author.

The last question, relying on a five-point Likert scale, examined the extent of the impact of using real-world design projects in interdisciplinary education. The distribution of response categories in Fig. 11 and the mean value of this scale (4.43), which corresponds to a “very strong” effect, reveal that the recruitment of realistic projects in this type of education, which

expose students to realistic problems and involve them in providing solutions, has a very strong effect on supporting creative problem-solving skill and finding effective solutions to various constraints, in addition to enhancing educational skills and practical experiences in communication and collaboration with various disciplines.

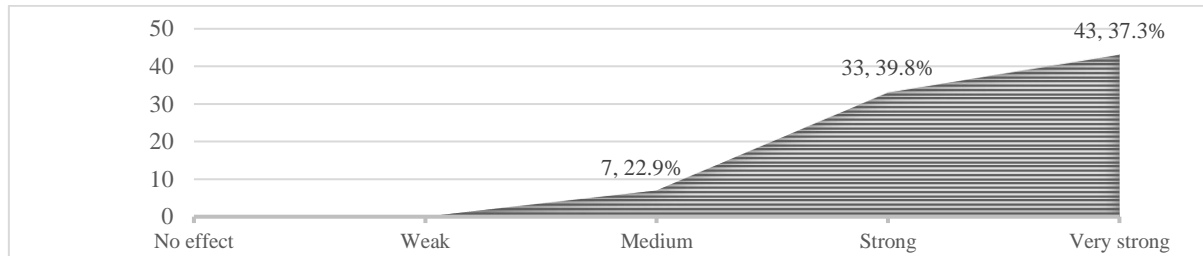


Fig. 11: Opinions on the impact of incorporating real-world projects on acquiring skills.
Source: Author.

6. PROPOSED VISUALIZATION FOR INTEGRATING INTERDISCIPLINARY APPROACH

This section integrates the inductive and deductive analysis findings to formulate a proposed framework for the mechanisms for integrating the interdisciplinary approach into undergraduate AD education that can be applied and tested, which aspires to be a fundamental pillar in architectural academia in the future.

The study, based on survey results, proposes the creation of a mandatory studio geared towards engaging various relevant disciplines in AD education called the interdisciplinary architectural design studio (IADS), to be included within undergraduate curricula in architectural programs in Egypt. This studio complements the main AD studio courses and is based on a solid base of knowledge and understanding of design fundamentals that are built in the main AD studios. IADS exceeds the boundaries of AD thought and combines the design strengths of both architectural and other disciplines, linking the artistic, scientific, theoretical, and practical aspects of design. The overall objective of the proposed IADS courses is to understand new dimensions in the architectural project design process from its inception to its completion to broaden the scope of students' thinking in AD and build competencies (knowledge and skills) that must be available in a century architect. It largely supports collaborative creativity, which is complementary to individual creativity, and thus the student will combine individual and collective design skills.

Based on the qualitative and quantitative analysis findings, a proposed vision for proposed IADS courses action mechanisms and management strategy were formulated, as its nature differs—as the study showed—from the nature of the main studio courses. This strategy requires a precise understanding of the nature of the disciplines targeted for integration, as it entails the adoption of new and diverse educational objectives, methods, and environments in AD education.

Table 9 shows the proposed vision for IADS courses, which can be applied, tested, and evaluated in future work, with the aim of including it in undergraduate curricula.

Table 9: The proposed visualization for the action mechanisms of IADS courses.



Participating disciplines	Artistic disciplines	Mathematical sciences	Engineering disciplines associated with AEC (structural, mechanical, electrical, construction management eng.)	Sub-disciplines of architecture (architectural urban, environmental design, urban planning, & landscape)
Learning objectives and outcomes	Promote creative design thinking skills	Promote creative design thinking skills + Build integrative and participatory design skills	Promote creative design thinking skills + Build integrative and participatory design skills	Promote creative design thinking skills + Build integrative and participatory design skills
Participants in teaching	Elite academicians from participating disciplines	Elite academicians from participating disciplines	Elite academicians, professional consultants from participating disciplines + graduates who hold important jobs.	Elite academicians, professional consultants from participating disciplines + graduates who hold important jobs.
Educational project	Studio-based design projects	Studio-based design projects	Realistic team-based design projects: Design-build projects	Realistic team-based design projects: Live projects
Work Method	Individual thinking	Group Thinking students from the same discipline	Group Thinking students from diverse disciplines	Group Thinking students from diverse disciplines
Proposed Semester	2nd Semester because it requires a base of knowledge & understanding of the fundamentals of AD that was built in the main ADS in 1st semester	1st Semester or 2nd semester	2nd semester Students should be familiar with the basics of execution designs and how to use BIM software.	2nd Semester or over the course of the academic year Students should be familiar with the basics of other disciplines.

Creating new dimensions in architectural design education

Source: Author.

7. CONCLUSIONS

With the increasing academic interest in the interdisciplinary approach as an entry point for the development of twenty-first-century skills, in light of the abundance of experimental studies that addressed the integration of this approach into AD education at the undergraduate level, as previously explained, and the positive results their reached, it has become necessary to move towards applying this approach in the local architectural academia. In line with Egypt's Vision 2030 for university education, the study presented a proposed vision for the IADS action mechanisms to be included in the undergraduate curricula at Egyptian universities.

The study has adopted two approaches: first, a qualitative approach to form a comprehensive idea about this integration, included understanding various action mechanisms, added values for students, and the most important challenges faced by this educational model. Secondly, a quantitative approach by conducting an electronic survey of a random sample of 83 architects to explore their views on applying this approach in AD education.

Qualitative analysis results revealed the role of the IADS in creating an educational environment that is characterized by diversity in all its aspects, whether at the level of disciplines, participants in teaching, educational projects, or the nature of thinking in design.

The questionnaire findings showed positive endorsement for the relevance and necessity of applying the interdisciplinary approach integration in AD teaching. It confirmed its strong impact on the AD learning process, its outcomes, and the acquisition of much new knowledge and century skills that qualify for fields of work. Most viewpoints agreed on applying this

integration through a design studio separate from the main studio, due to their awareness of its different and complementary role to it. Finally, they reported their opinions on the impact of various action mechanisms that could be applied in this type of education, which included participating disciplines, teaching participants, work methods, and educational projects.

This paper addresses one of the fundamental topics in the educational arena that is consistent with the strategic goals of higher education in Egypt's Vision 2030, and which has a significant impact on both architectural education and practice. The study contributes to: First, adding a new dimension to AD education by integrating the interdisciplinary approach that tends toward cognitive and intellectual connectivity between architecture and related disciplines to produce cognitive and skill outcomes compatible with the century's needs. Second, paving the way for the application of this approach in architectural academia, as these ideas constitute a guide for academics. In this context, interested researchers are encouraged to test the proposed framework for its development or provide alternative methods that contribute to achieving desired goals.

Acknowledgments: I owe great credit to all researchers who conducted the empirical studies that were used as a reference for preparing this research study. I also extend my sincere thanks and special appreciation to all the architectural practitioners and academics for their participation in the study's investigation. Thanks to the findings included, the proposed vision was prepared.

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إطار مقترح لدمج النهج البيئي في تعليم التصميم المعماري بمرحلة البكالوريوس

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ملخص البحث

يشهد القرن الحادي والعشرين تطورات مستمرة وتحديات متنوعة لا يمكن فهمها من منظور التخصص الواحد، مما دفع الأوساط الأكاديمية إلى الاهتمام بالنهج البيئي كمدخل لاكتساب المهارات اللازمة لمواجهة هذه التحديات ولإبداع حلول تتجاوز نطاق التخصص الواحد. ومن هذا المنطلق، وفي إطار الحرص على تطبيق هذا النهج على الساحة الأكاديمية المعمارية المحلية، تهدف الدراسة إلى تقديم رؤية مقترحة لدمج النهج البيئي في تعليم التصميم المعماري (AD) من خلال استحداث استوديو التصميم المعماري البيئي (IADS)، لادراجه ضمن مناهج مرحلة البكالوريوس. ولتحقيق الهدف، اعتمدت الدراسة أولاً على المنهج الاستقرائي لتحليل أحداث اللدبيات التي سجلت تجارب حول هذا النهج، بالإضافة لتحليل أمثلة من الوضع الراهن قامت بتفعيل هذا النهج على الساحة المعمارية العالمية والمحلية، وذلك لفهم الجوانب المختلفة المتعلقة بهذا الدمج. وثانياً المنهج التحليلي الاستدلالي من خلال إجراء مسح استقصائي لقياس مدى أهمية وفاعلية تطبيق هذا النهج في تعليم التصميم المعماري، والآليات التي يجب أن يستند عليها الاستوديو المقترح. واختتمت الدراسة بتحويل الدروس المستفادة إلى إطار عمل مقترح يمكن تطبيقه واختباره، وينجّه نحو ربط الجوانب الفنية والعلمية والنظرية والعملية وتوفير بيئة تعلم مشجعة على بناء كفاءات القرن.

الكلمات المفتاحية: التعليم البيئي، التصميم المعماري، استوديو التصميم، كفاءات القرن الحادي والعشرين، التفكير التصميمي البيئي