Assessing The Impact Of Architectural physical Models in Architectural Design Education.

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Abstract
Compositional Physical models can be characterized as smaller than expected models that are executed with various materials and diverse scales to copy in their final shape or structures or urban context...etc, These models can create to probes wind movement, sound echo … and so on, and produced additionally in different phase of the building configuration process, The significance of engineering physical models is plainly through the history, beginning from the models of the antiquated war zone until the point that the advertising models which delivered to showcase the different engineering ventures, yet what is critical to this investigation is these models which delivered amid the procedure of project for building up the design.The current origination of architectural design education in many Departments of Architecture in colleges in Egypt could be a blend between manual (freehand drawings, sketches, physical models) and computerized approaches, the blend between these two different ways should be clear by sleuthing once should students utilize the customary or advanced ways.The goal of this paper is to evaluate the effect of Architectural Physical Models use on the final design outline, an open-ended survey was intended to quantify factors identified with students' inclinations toward utilizing physical models amid configuration forms and computerized demonstrating program.

Keywords : Architectural Design proceses, Concept, models, Architectural Education.

Nomenclature :

APHMs	Architectural Physical Models.
DMPs	Digital Modelling Programs.

1. Introduction

Amid the most recent couple of years, progressive advancements in the field of Information and Communication Technology have altogether affected regular day to day existence. The web, propelled representation instruments and programming are evident cases of this computerized insurgency that has influenced the way toward instructing building outline, the improvement of this advanced apparatuses over a moderately brief time and their nonstop progression and refinement had, and keeps on having, an unavoidable significant effect on numerous key academic parts of design training.

Despite the fact that DMPs was brought into the majority of architecture department in Egypt, however students are not permitted to utilize it unless they complete their initial two years of architecture design program as they should, because of their educational modules, to take in the essential hand sketching and other hand relational abilities so as to apply it in their designs.

In any case, in the third to the fifth years they are urged to us the two strategies in outline, that are the APHMs and the DMPs, Although this progress isn't plainly tended to, therefore students are left unfit to actualize this mix of techniques when required. Also, a few students are not ready to utilize DMPs devices in outline distinctive procedures, for instance, they can't utilize DMPs to better comprehend their ventures' diverse segments and frameworks, for instance the structure, electro-mechanical, warming, ventilation, and aerating and cooling, and so on. DMPs are not educated as analatical or design program or form maker, in this way students are not ready to examine the environmental analysis of the site.

As a result, students are not ready to execute their educated abilities in DMPs to their designs in viable way.

This paper exhibits a system to survey the effect of APHMs on the design process. This structure centers around a gathering of markers that were researched: compositional program; site analysis; concept; design development and final poster. This evaluation may uncover certain markers that can enable teachers and specialists to comprehend the effect of this fast and radical progress on the design to process and consequently help to divert the eventual fate of compositional instruction into a more versatile and subjective (Figure 1).

Figure 1. sample of using freehand drawings, Physical and Digital Models.

1.1. The Research problem:

The present idea of architectural education is a mix of the customary technique for manual utilize and the cutting edge strategy for utilizing DMPs in design procedure. This paper contends that the change to the new advanced programs has been ambiguous and to a great extent poorly characterized, which causes a few genuine educational issues. The presentation of these new apparatuses into configuration instructing has been joined with a broken connection between the devices and the proposed end assignments, this brokenness has brought about a partition between final design and the setting of the venture, particularly its feeling of scale and proportion, and has prompted a stamped decrease in the spatial quality experience and a lopsided reliance on illustrative methods. The wrong utilization of the computerized devices and the substantial dependence on them, the absence of combination among various advanced apparatuses and, all the more essentially, the nonappearance of powerful coordination between hypothetical courses and configuration the projects has brought has brought a poorer final designs.

1.2. Research Objective:

The point of this paper is twofold. To start with, this investigation quantitatively investigates students' inclinations and states of mind toward the utilization of DMPs instruments and APHMs. Second, this examination surveys the potential effect of APHMs on the quality and innovativeness of final designs by analyzing configuration of the projects. The fundamental goals of this paper can be abridged as takes after:

- What impacts do APHMs have on the design stages (theoretical studies, analysis, and so on)?
- What atract students to utilize APHMs in their designs?
- What is the part of APHMs in an engineering educational modules and its significance?

The general point of the investigation is to look at the impact of APHMs on Architectural designs.

1.3. Definitions:

Architectural Education:

The progress of the data PC innovation upheaval with the went with computerized advancements has changed the conventional setting of design as a calling and in training.
A few investigations showed that computerized innovations have been utilized as a part of building schools to challenge the modernizing perspective of compositional practice (4,9).

Additionally showed that computerized advances has influenced both staff individuals and students regarding their aptitudes and the setting of instructive and expert culture. At the same time, joining conventional outline approaches with advanced innovation is viably enhancing building practice. Likewise advanced innovations has

been utilized by schools of engineering to change design creative ability and compositional viable possibilities(4).

In any case, architecture schools are getting to be research facilities for different advanced design media, and the compositional studio itself has turned into a space to look at the part of PCs in architectural designs (3,6,7).

Students have expanding inclinations toward computerized advancements and are ending up more gifted and associated with utilizing different design media in their projects, which, thusly, has influenced the conventional design studio culture.

some authers accentuated that advanced innovations, as utilized as a part of the e-studio, can convey imperative changes to the architectural design process however may have unintended confining impacts (3).

Conversely, some cautioned that this change towards advanced engineering ought to be reexamined whether in term of training or instruction. In the first place, advanced devices could supplant, the customary plan apparatuses, for example, manual skitching that frequently gives the vital direct physical connection between the hand and the mind. Second, advanced instruments has given an appealing, simple, and modest other option to structural physical models and has supplanted them with an arrangement of enticing illustrations that are generally intended to inspire the clintes (1).

The drawback of utilizing DMPs is to make the students dependent and outline their ventures without creativity(8), likewise the utilization of DMPs by students came as right on time as the theoretical stage in the examination of particular formal subjects (1). In any case, numerous staff individuals and experts have required a blend of both physical and advanced design strategies instead of the utilization of either technique independently. Breen demonstrated that the blend of the two strategies gives the architect included bits of knowledge and the sky is the limit from there "genuine" ways to deal with create, reevaluate and refine any design (Figure 2). Breen likewise underscored that the blend of the two procedures ought to be effectively fused in the instructive educational programs to set up the students as they advance toward training (3).

Architectural Design:

Engineering configuration is an intricate procedure of making a rational structure or framework that involves numerous brought together components. Amid the most recent couple of years, numerous theoreticians and experts have endeavored to characterize " design ". some characterized it as: "An objective coordinated critical thinking activity"(5). Others characterized it as "an imaginative action that includes bringing into being something new and valuable that which show new physical request, association, frame, because of function"(2). Likewise characterized as "... the making of an integrated arrangement as items, procedures or frameworks that fulfill apparent needs through mapping between the practical necessities in the utilitarian area and the plan parameters of the physical space, through appropriate determination of the outline parameters that fulfill the useful prerequisites (11)." Over the most recent couple of years, engineering has been impacted by the expanding utilization of computerized innovation all the while and in the ultimate result of configuration to meet certain useful, social, stylish, natural, and financial needs.

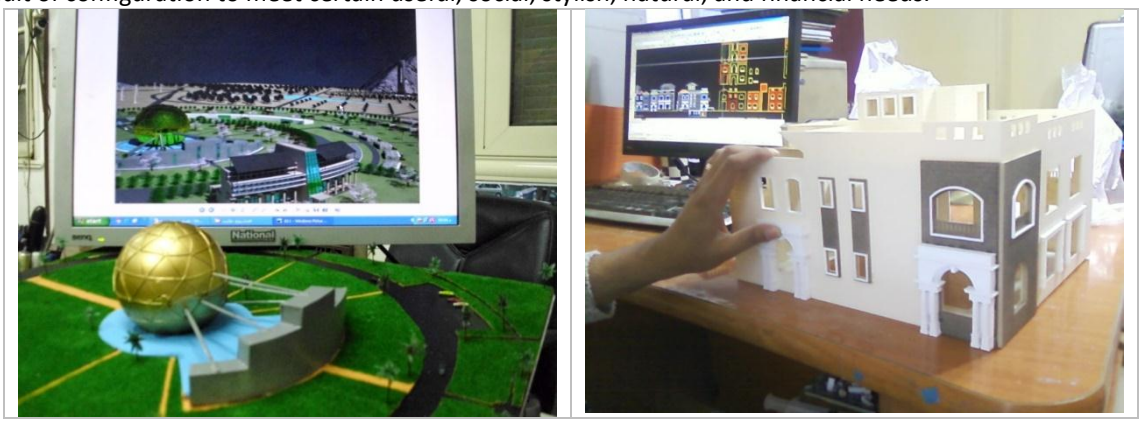


Figure 2. sample of combination of both physical and digital design methods.

2. Research methodology:

The examination centers around the effect of the APHMs use on students projects in schools of engineering in Egypt. three colleges in Egypt, in particular, Helwan university, College of fine arts, Architecture Department - Arab Academy for Science, Technology& Maritime Transport, College of Engineering & Technology, Architectural Engineering and Environmental Design Department and Modern Academy for Science& Technology, Architectural Engineering Department were chosen as the examination cases. The accompanying table outlines the APHMs utilize appraisal strategy which is utilized all through this examination.

Interviews and Questionnaire Surveys	**Students & Staff Members**		**Criteria to Assess the Impact of APHMs Use**	**Design Projects**	
	1	Questions that determine preferences and attitudes toward the use of APHM?		**1**	Analysis
	2	Questions on the advantages of using APHM compared with DMPs?		**2**	Architectural Concept
	3	Questions regarding the integration of APHM with other subjects of the Architecture Curriculum?		**3**	Design Development
				4	Final Presentation
Architectural Design Education Quality					

Table 1. the APHMs use assessment methodology.

This examination likewise utilized a contextual analysis way to deal with collect the fundamental information through the accompanying:

2.1. Interviews and Questionnaire Surveys:

A. **Qualitative interviews:** he information utilized for assessment depended on subjective inside and out meetings that were directed with an example of design students, and staff individuals.

B. **Questionnaire survey:** a broad study poll was finished by 30 students and 15 staff part in the examination region.

The led meetings and survey included open ended inquiries in view of gathered subjective information from the students, for example, students' inclinations and dispositions toward the utilization of APHMs, the kinds of APHMs utilized by students, APHMs learning technique, capability level in APHMs, the recurrence of utilizing APHMs in various design stages (10), and the benefits of utilizing APHMs (Table 2).

Main questions	**Sub-questions**
Questions that determine preferences and attitudes toward the use of APHM?	**Q1**. Attitudes toward the importance of APHM compared with DMPs.
	Very Positive
	Positive
	Neutral
	Negative
	Very Negative
	Q2. Priority of using APHM or DMPs
	APHM
	DMPs
	Both
	Others
	Q3. Type(s) of APHM used by students?
	Primary models

	Study models
	Test models
	Detailed models
	Q4. APHM Learning?
	Self-learning
	Architecture Curriculum courses
	Private classes
	All of this
	Q5. The using of APHM in different design phase?
	Analysis
	Conceptual
	Design development
	Final presentation
	Q6. Proficiency level in APHM?
	Very High
	High
	Average
	low
	Very low
Q.7 Questions on the advantages of using APHM compared with DMPs?	accuracy
	neatness
	speed
	Save money
	Masses impact
Q.8 Questions regarding the integration of APHM with other subjects of the Architecture Curriculum?	History
	Theory
	Environmental
	Structural

Table 2. questionnaire to measure variables related to students' preferences toward Architectural Physical Models (APHM) and Digital Modelling Programs (DMPs)

2.2. Criteria to Assess the Impact of APHMs Use:

Four fundamental criteria were surveyed the quality of the designs with a similar score weights that totalled 100. These criteria were:

A. Analysis (25 focuses).
B. architectural idea (25 focuses).
C. design development (25 focuses).
D. final poster (25 focuses).

The criteria are essentially simple, yet the building idea paradigm needs some elaboration as take after (Table 3):

(Stage A) demonstrates that undertaking examination was subdivided into 4 fundamental focuses as per their responsiveness to their: (1) coordinate urban setting, (2) natural setting, atmosphere, geology, and so forth.; (3) plot's shape, region and area, lastly Appropriateness of the utilization of APHMs to build up the general site outline.

(Stage B) demonstrates that design idea was subdivided into 6 fundamental contemplations. Initial (1), a philosophical and scholarly premise is embraced to clarify the idea and calculated advancement and shows how students touched base at their last arrangement and whether any plan reference or point of reference was received. Second (2), stylish and imaginative contemplations allude to the general formal, spatial and sculptural parts of the venture, including proposed materials, hues, examples and surfaces. Third (3), local

and social components allude to how the understudy reacted to the feeling of place and whether social impacts, for example, neighborhood and additionally territorial compositional legacy had any part in the general plan or building pattern that was embraced. Fourth (4), ecological contemplations incorporate the students reaction to the subject of manageability, vitality utilization, climatic variables, for example, introduction and sunlight based shading gadgets, and so forth. Fifth (5), the suitability of the embraced slant alludes to what degree the plan approach has prevailing with regards to being significant and workable with the general capacity of the projects. The last Sixth (6) thought is the level of utilization of the APHMs, to build up the last arrangements.

(Stage C) demonstrates that design development was subdivided into 3 fundamental focuses as indicated by their: (1) Use of suitable auxiliary frameworks, (2) Submission of full illustrations and points of interest , staircases, opening, joints, and so forth.; (3) Conform The compositional plans to the construction standards appropriate in the zone, and beyond any doubt for distinguished if APHMs aid to the final design improvement.

(Stage D) demonstrates that Architectural Presentation "final poster" was subdivided into 4 primary contemplations. Initial (1), Overall publication configuration topic and lucidity. Second (2), Compliance to 2D least accommodation prerequisites (plans, elevation, sections, layout, and so forth.). Third (3), Compliance to 3D prerequisites (3D viewpoints (outside and inside), subtle elements, and so forth.). Fourth (4), APHMs: Compliance to present a recent report models demonstrating design improvement at various stages.

(Section A)	(Section B)	(Section C)	(Section D)

Figure 3. sample of using Physical Models in Architectural designs at different Phases.

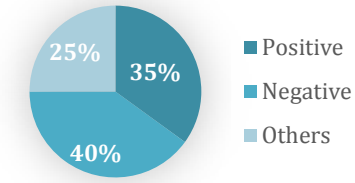
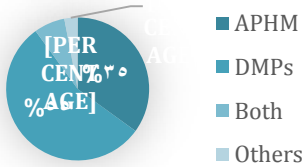
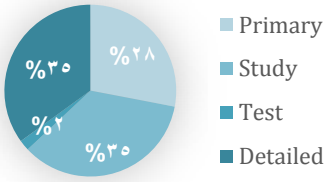
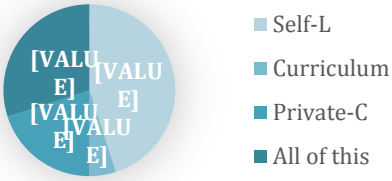
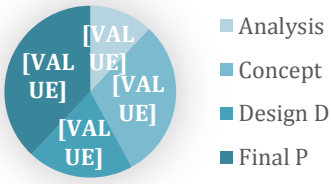
A	Analysis	25 points	1	2	3	4	5	Total A
1	Response to urban context, surroundings and accessibility							
2	Site layout, topography and overall landscape design							
3	Appropriateness of plot's shape, area and location							
4	Use of APHMs to develop the overall site design							
B	**architectural concept**	**25 points**	**1**	**2**	**3**	**4**	**5**	**Total B**
1	Philosophical and intellectual basis adopted to explain the architectural concept to client							
2	Quality of conceptual development and evolution of main design theme							
3	Aesthetic and artistic considerations							
4	Regional/cultural/environmental considerations							
5	Appropriateness of adopted design approach to overall function and context							
6	Appropriate use of APHMs in generating design?							
C	**design development**	**25 points**	**1**	**2**	**3**	**4**	**5**	**Total C**
1	Use of appropriate structural systems							
2	Submission of full drawings & details							
3	Conform The architectural designs to the building codes applicable in the area							
d	**final presentation**	**25 points**	**1**	**2**	**3**	**4**	**5**	**Total D**
1	Overall poster design theme and clarity							
2	Compliance to 2D minimum submission requirements (plans, elevations, sections, site plan, etc.)							
3	Compliance to 3D requirements (3D perspectives (exterior & interior), details, etc.)							

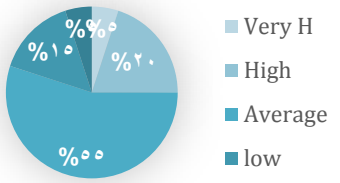
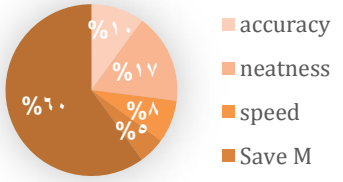
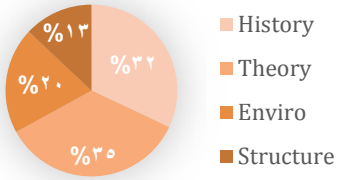
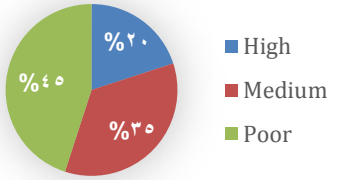
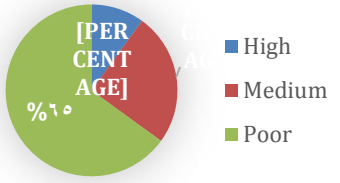
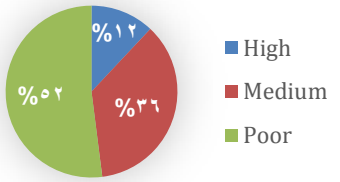
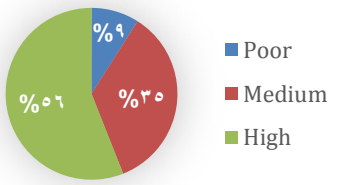
4	Physical models: Compliance to submit several study models showing design development at different stages								
	Total score	**100 points**							

Table 3. Matrix of main criteria assessed for the impact of APHMs on the quality of architectural design product(10). (scores 1 poor to 5 high)

3. Results of questionnaire & matrix:

The meetings and poll Surveys finished by (30 architecture students, who have procured and created different plan aptitudes and rehearses and whose studio work joins conventional and new structural outline techniques; and 15 staff individuals from three colleges in Egypt (Helwan university, College of fine arts, Architecture Department- Arab Academy for Science, Technology& Maritime Transport, College of Engineering & Technology, Architectural Engineering and Environmental Design Department and Modern Academy for Science& Technology, Architectural Engineering Department).

Interviews and Questionnaire Surveys	Questions that determine preferences and attitudes toward the use of APHM?	Attitudes toward the importance of APHM compared with DMPs?		40% of case study described their attitudes positively for DMPs
		Priority of using APHM or DMPs?		55% of case study preferred to use DMPs over APHMs
		Types of APHM used by students?		70% of case study usually use study & final detailed model in their projects, 28% use primary models for analytical study and very limited ratio use test models
		APHM Learning?		45% of case study gained proficiency in APHMs by self-learning, and 30% by combination of self-learning, Architecture Curriculum courses & Private classes
		The using of APHM in different design phase?		38% of case preferred to use APHMs in final presentation with full detailed physical model, and 30% preferred to use APHMs in concept phase

		Proficiency level in APHM?		55% of case study evaluate their proficiency level in producing APHMs with average level, however 20% evaluate their proficiency with high level
	Questions on the advantages of using APHM compared with DMPs?			60% of case study seen that APHMs highest advantage is for masses design
	Questions regarding the integration of APHM with other subjects of the Architecture Curriculum?			67% of case study confirmed the importance between APHMs and the subjects (theory& history).
Criteria to Assess the Impact of APHMs Use	Analysis			Only 20% to 35% of the 2nd, 4th year architecture projects had used physical models in analyzing or planning the site
	architectural concept			Only 10% to 25% of the 2nd, 4th year architecture projects had used physical models in creating their concept
	design development			Only 12% to 36% of the 2nd, 4th year architecture projects developed by using APHMs for masses& skins pattern, with little or no attention paid to regional, cultural and environmental or artistic considerations.
	final presentation			Only 9% to 35% of the 2nd, 4th year architecture projects had used physical models in final presentation

4. Conclusions:

This paper evaluated the effect of APHMs on the design procedure and on the final design quality at differnt engineering schooles in Egypt, which blends conventional outline strategies with computerized techniques, The Analyses uncovered that despite the fact that larger part of students were found to have a solid propensity to utilize DMPs for its different preferences, for example, exactness, tidiness, speed and lower cost, and so on. And furthermore architectural departments in the majority of the compositional divisions in Egypt does not support the utilization of DMPs in early period of the design.

Investigations of some of design projects demonstrated that advanced digital models has turned out to be exceptionally basic, with the goal that other physical models and draws that address better sensible parts of configuration, are rejected. Degital displaying in the greater part of the broke down activities were supplanting the physical model. In this manner, students' projects were neither sensible nor exhaustive and there were no similarity between thethe different set of drawings.

This ought to be settled by incorporating both: physical and computerized strategies in design proces. This reconciliation would build students' involvement of request, disclosure and portrayal and this prompts imagination.

Additionally we as staff members have the duty to show APHMs courses in inventive route, as augmentation to our imaginative potential outcomes.

At long last, physical models and other computerized advances should be locked in inside the architectural designs in early stages so such apparatuses would be utilized to give imaginative outline. In addition, advanced innovation ought to be used as a basic piece of the new design studio culture that coordinates with other subjects and courses in the engineering instruction educational modules. Coordinating physical modeling& advanced digital programs into architectural education help to make more responsive designs as far as: structural, environmental, urban, and other subjects.

5. References:

1. Achten, H. (2003). “New Design Methods for Computer Aided Architectural Design Methodology Teaching,” International Journal of Architectural Computing 1, no. 1.
2. Alexander, Christopher (1961) "Information and an Organized Process of Design," in National Academy of Sciences, Proceedings of the Building Research Institute (Washington, D.C.: National Academy of Sciences, 1961), 115-24.
3. Al-Qawasmi, J. (2004). Reflections on e-design: the e- studio experience. 1st ASCAAD International Conference, e-Design in Architecture, KFUPM, Dhahran, Saudi Arabia, pp.177-193. Al-Qawasmi, J. (2005), Digital media in architectural design education: reflections on the estudio pedagog’, Art, Design & Communication in Higher Education 4(3), pp.205– 222.
4. Andia, A. (2002). “Reconstructing the Effects of Computers on Practice and Education During the Past Three Decades,” Journal of Architectural Education 56, no. 2 (2002): 7-13.
5. Archer L.B. (1964) Systematic Method for Designers, (Council for Industrial Design, London).
6. Ataman, Osman (2000) Media effect on architectural design, College of Architecture, Georgia Institute of Technology. Retrieved from http://cumincad.scix.net/cgi-bin/works/Show?83c4
7. Ataman, Osman and Lonnman, Bruce (1996) Introduction to Concept and Form in Architecture: An Experimental Design Studio Using the Digital Media, Design Computation: Collaboration, Reasoning, Pedagogy [ACADIA Conference Proceedings / ISBN 1-880250-05-5] Tucson (Arizona / USA) October 31 - November 2, 1996, pp. 3-9. Tuscan , AZ: ACADIA.
8. Guney, D. (2015). “The importance of computer-aided courses in architectural education,” Procedia-Social and Behavioral Sciences, 176, 757.
9. Schenk, P. (2005), Reflections on the teaching of drawing in the digital age: attitudes of senior academics in the United Kingdom to the place of drawing tuition on the design curriculum in higher education, Art, Design & Communication in Higher Education 4(3), pp. 189–203.
10. Rana, Ihsan Fethi (2017). “Assessing The Impact Of Caad Design Tool On Architectural Design Education,” Malaysian Online Journal of Educational Technology (Volume 5 - Issue 1), 5, 8.
11. Suh, N.P. (1989) Principles of Design, (Oxford University Press, London).

6. Appendix:

P. N	001	Project: **Welling Center in Helwan**
Date	June 2017	

Final Grade: Very Good

Architectural Phyaical Model

Final poster

P. N	002	Project: **Terminal Gate at Jezert El-Dahab, Giza, Egypt.**
Date	June 2017	

Final Grade: Very Good

Architectural Phyaical Model

Final poster

Sample of student's project in models lap in architecture department College of fine arts, Helwan university.