

Toward Teaching Cost Conscious Design in Architectural Design Education

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Abstract

Sufficient housing influence individual's well-being and quality of life. While architectural profession represents to provide innovative design with quality and high standard, it is also their responsibility to seek solutions to fulfill varying needs of people in global economic inequality. While architectural education is meant to proliferate such exploration, this study is concerned that current foundation design education does not inform students with the financial aspects of architecture to produce realistic designs. The following text examined different and yet, similar perspectives in teaching cost as a design determinant during the architectural foundation design education. This research included key informant interviews with experts who represent various disciplines within the built environment. These experts shared their perspectives in the significance of cost awareness in design and shared ideas to improve and challenge design quality at low cost. The key informant interviews confirmed that there is a gap in architectural education pertaining to the topic of cost as a fundamental design determinant, and identified the importance of teaching such topic in architectural foundation design education

INTRODUCTION

At the 69th annual Association of Collegiate Schools of Architecture meeting in 1982, Comerio and Protzen of University of California at Berkeley raised concerns about the shrinkage of architectural services. They stated that, along with proliferating specializations in the profession of architecture, architectural education no longer bothers to make the economic and financial problems of buildings its own (Comerio and Chusid 1982). Twenty years later, in 2012, an international conference called 'Ghost 13' was held to discuss architectural education asking questions such as 'what should we teach?' and challenging the current architectural curriculum. A coherent architectural and educational response to inequality of the global economy was among one of the leading topics discussed with a concern that iconic and often expensive houses being as examples of the quality craft in today's construction.

Every year, approximately 27,000 students graduate from accredited architecture schools (National Architectural Accredited Board [NAAB] 2013). Despite this large number, research finds that only 1% of registered architects are interested in affordable [housing] projects. It could be that projects with tight cost constraints do not generally conjure thoughts of architectural innovation, and often address only one problem, shelter, amid many other concerns of built environment. However, as Stansfield Smith (1999) stated the key to a successful architectural profession is not only that profession's ability to represent quality and deliver high standards, but also its ability to represent the values and aspirations of the society it serves (Standfield Smith 1999). Architectural education may serve its purpose when it educates people to the responsibilities of practical, ethical, and political architecture, but these responsibilities can only be understood when students are aware of what is happening in the world (Libeskind 1995).

Research finds that what one commonly sees in architecture schools is the separation of academic minds from the world around them. Expensive houses or heroic projects are often examples of the quality and quantity of distinguished architecture in today's landscape. This viewpoint leads to a lack of awareness in the disparity of the individual financial resources (Fisher 2012). Gellner blamed the architectural educational system for this concern. He argued that the problem is rooted in the design education that its tendency is to separate design, conceptual education and technical education, and university context from the real world (Gellner 2011 and Dutton 1982). Furthermore, architectural educators encourage students to provide unique designs in response to studio projects, and since the students lack in practical training, their design responses often result in costly solutions (Gellner 2011).

Moreover, the recent tendency in design education has become toward shaping “signature architects” like Frank Gehry or Zaha Hadid, rather than nurturing fundamental skills and architectural contributions to society (Nicol and Pilling 2000).

Similarly, Morrow (2000) attested that teaching in architecture schools assumes similar backgrounds, social class, aspiration, and political affiliations, and such assumption in architectural education contributes to the failure of architects to take account of different needs, which is crucial to consider in design. He added that understanding of users and their different needs affect how the users perceive and utilize the space. Morrow wrote that because the architectural education excludes social factors during design, it results in poor design. In addition, such architectural assumptions separate architecture apart from the society and its context, thus he recommended more inclusive design teaching, which develops a deeper understanding of user context in respect to others.

This study is concerned that current foundation design education does not inform students of the cost aspect of architecture in producing realizable designs. In addition, current foundation design education understates modest architectural projects that do not require wealth, yet demonstrate that aesthetically pleasing, functional, and affordable designs can be achieved. Designers’ ethical responsibility extends beyond wealth, and architectural education plays a key role in this transition.

COST AWARENESS IN ARCHITECTURAL DESIGN EDUCATION

Vitruvius described the importance of economy in the Book 1. He stated that obviously the plans need to be carefully developed with the greatest attention before the structures are begun, and that it is the tradition and architectural practice to calculating and stating the limit of expense. Vitruvius stated that is a part of the education of architects (Vitruvius et al. 1914/1960):

In the famous and important Greek city of Ephesus there is said to be an ancient ancestral law, the terms of which are severe, but its justice is not inequitable. When an architect accepts the charge of a public work, he has to promise what the cost of it will be. His estimate is handed to the magistrate, and his property is pledged as security until the work is done. When it is finished, if the outlay agrees with his statement, he is complimented by degrees and marks of honor. If no more than a fourth has to be added to his estimate, it is furnished by the treasury and no penalty is inflicted. But when more than one fourth has to be spent in addition to the work, the money required to finish it is taken from his property. Gentlemen would not be misled into limitless and prodigal expenditure even to ejections from their estates, and the architects themselves could be forced, by fear of the penalty, to be more careful in calculating and stating the limit of expense, so that gentlemen would procure their buildings for that which they had expected, or by adding only a little more (Vitruvius et al. 1914/1960, p. 281).

Schon (1988) called design studio a virtual world, relatively free of the pressures, distraction and risks of the real world, but yet it is a setting designed for the task of learning a practice. In this practice world, students learn by doing, by undertaking projects that simulate and simplify practical aspects of architecture. Notwithstanding its fundamental grounds, the architectural design studio is geared toward being innovative without providing practical and real solutions. The greatest weakness of architectural education has become a lack of preparedness for architectural practicality.

Winter (1984) indicated while it is the architect’s obligation to design buildings with values at its optimal cost effectiveness, there is a lack of incentive for such effort and often architects are not compensated to research alternates for cost savings. In spite, organizations such as the Department of the Housing and Urban Development, National Science Foundation, and the National Bureau of Standards continuously study and invest in research to reduce building cost through “design, construction techniques, technology, energy conservation, durability, life safety, and hazardous reduction” (Nicols and Pillings 2000, p. 278). He also, attested that regardless of its significance, architectural schools do not emphasize training future architectural designers to design with optimal cost effectiveness through its education. Winter concluded that the architectural education should consider addressing building elements deemed to add value attributing to cost and benefit of the building. Winter advocated for the architecture schools to develop research and teaching programs with an aim to develop cost effective design.

Fisher (2012) summarized and narrated educational discussions led by MacKay-Lyons for the March 2012 edition of the *Journal of Architectural Education*. A group of educators and practitioners gathered at an international conference to discuss what should be taught in the beginning design curriculum. The participants posited that wealth is required to fund examples of quality and quantity of craft in today's construction; however they recognized the issue is not only concerned with economics, but also socio-ethical responses. Architectural education should more firmly address issues of social, political and economic relevance, such as the control and distribution of the world's resources, landownership, class conflict, methods of capital accumulation, and political/economic power and its effect upon social decision-making (Dutton 1982). Dutton provides demanding implication that architectural education must stop excluding social, political, and economic realities from students. Undiscovered at school, students design in "an imaginary universe", and there must be integration of educational context and the "real world" context (Dutton 1982, p.145). If these issues are taken into account when designing, the physical structure, architecture can be practiced in ways that it may alter the prevailing political and economic structure of society today.

In the interview with Winston (2016), the 2016 Pritzker Prize winner, Alejandro Aravena addresses the importance in learning budgetary constraints in architecture school. Aravena called himself lucky that he happened to be engaged with right people interested in economy and policy of the building industry. He also, noted that with more than one million architects in the world, presumably there would be more solutions and more proposals try to address the issue in lack of quality social housing if architectural education attends to these topics. Nonetheless, budget constraints are intertwined with building logic, political framework, and policies that are too vast for architecture education to include. Architects do not have to become policy makers or economists, but "our contribution to a problem is as designers" (Winston 2016, para 63).

On the other hand, Patric Schumacher of Zaha Hadid Architecture criticized the selection of this year's Pritzker Prize Laureate, Alejandro Aravena. He condemned that the Pritzker Prize has mutated into a prize for humanitarian work. Although he did acknowledge that Aravena's "half a good house" projects were an intellectual solution to the lack of affordable housing crisis, but like Schumacher, most architects see ideal projects as iconic, timeless, radically futuristic (Solis 2016). As Solis argues, a deep understanding of the economic context can effectively guide architectural ingenuity as much as understanding of the formal, spatial, or geographic context of a project. What Aravena has achieved to deserve the Pritzker Prize is that he demonstrates the understanding of the economic context of architecture by looking at an economic limitation not as a compromise, but as an opportunity. Architects and other design professionals should recognize the fact that economics and finance drive the solutions they come up with to address many design challenges. Such understanding of economics and finance may be the additional skill set architects and other design professionals need to create design opportunities.

METHOD

The key informant interviews were conducted to discover the similar and different views on teaching cost in architectural design studio education by different disciplines within the architectural industry. The interviews were to identify what needs to be taught in the foundation design studios to help students understand cost as a design determinant in order to improve the quality of their design. The key informants were selected based on their contribution and involvement in architecture education and the building industry. Each key informant had specific knowledge of economic and practical design, and affordable housing construction as well. The interviewees include one (1) local builder, one (1) architectural design professor, one (1) construction science professor, two (2) practicing architects, and two (2) directors from affordable housing organizations. All seven (7) participants attested their substantial involvement in the architectural education and practice. Their years in experience varies from 15 to 30 plus years in architecture and construction. Conversational results from each participants are coded as indicated in below Table 1.

Table 1: Participants for key informant interviews

Participant Code	Primary role the field of architecture
Interviewee 1	Professor in the Department of Construction Science
Interviewee 2	Non-Profit Organization in Housing
Interviewee 3	Non-Profit Organization in Housing
Interviewee 4	Local Home Builder
Interviewee 5	Professor in the Department of Architecture
Interviewee 6	Architect
Interviewee 7	Architect

Interviewee 1, a construction science professor, is currently teaching construction management courses including cost estimation. He expressed that he tends to put a heavy weight in design students' understanding of building construction and financial implication. He believed that realistic and practical realization in design projects would make the students better architects and construction managers. Interviewee 2 and 3 are financial and construction managers at non-profit affordable housing organizations. Over the past fifteen (15) years, they have collaborated with Texas A&M University exposing architectural design students to building construction. Interviewee 4, a local builder, lectures at various institutions and conferences internationally promoting quality affordable housing using alternative materials. During the interview, he also advocated in the significance of alternatives construction materials and methods and the importance of learning building elements in order to achieve quality design at low cost. Interviewee 5, an architectural design professor, has been teaching architecture at various design institutions for over ten (10) years. In his interview, he spoke of seeing architecture as a form in design education, carefully separating design education from practical rim. Interviewee 6 and 7 were both design practitioners who face cost as a design determinant in their day-to-day practices, and applauded in the idea of cost awareness in young designer's mindset.

RESULT AND FINDINGS

The following text explains findings from the interviews. The interview responses were organized to elucidate similarities and differences between disciplines in design and construction. It should be reminded that although these experts represent culture and principles of their own disciplines, it would be misleading to generalize their opinions based on the particular participants as the sole contributors to this interpretation.

The first question sought the optimal time to discuss cost or budget in any architectural project.

The construction science professor explained his experience with the Perot Family, the wealthiest family in Texas. When the Perots started planning for Perot Museum in Dallas, they had a set budget for the project, and it was closely monitored and recognized throughout the design and construction. He also stressed that architects must understand budget and financial constraints at the early stage in the process. Similarly, the local builder also added that "there are unnecessarily elements in building, and if it could function without, we basically don't need them. Keeping it simple. Everything has budget" (Interviewee 4 personal communication, January 14, 2015).

Table 2: When do you think is the most optimal time to discuss cost in architectural project?

Participants	Response
Construction Science Professor	Cost shall be considered at the conceptual stage of the design
NGOs in Housing	Even before any design is considered, budget should be the first thing discussed
Local Builder	From the beginning-it effects everything
Architectural Design Professor	While they are designing
Architects	Early on... very beginning, as early as possible

As the architects explained, "while no architect wants to design frugal buildings, but it is the mindset" (Interviewee 7 personal communication, February 3, 2015). It was agreed by all interviewees that, cost implications for any projects must be discussed at the programing, the conceptual stage, or at the start of the project. Not only the construction cost or budget is the first topic that the design team discusses, but it also effects everything from design to construction.

The second question sought the optimal time to expose design students to cost implication in architectural design. While the six (6) interviewees agreed with the idea of foundation design students cultivating the mindset of building cost during design, only the architectural design professor responded that cost awareness should be introduced only when the students start working on buildings, which is generally by the third year in the architectural program. Even then, he insisted that it should be exploratory and not driving students’ design. This result indicates that industry practitioners are faced with the hardship of financial needs on day-to-day basis opposed to the design educators who have indirect opportunity to experience these basic assumptions in the field (Glasser 2000).

Table 3: When do you think is the most optimal time to expose students to cost implication in architectural design?

Participants	Response
Construction Science Professor	As early as possible, starting from the very first semester
NGOs in Housing	From the first year
Local Builder	From the beginning-it effects everything
Architectural Design Professor	When they start working on buildings fully – by the third year and even then it should be exploratory
Architects	Very early in the foundation years

Interviewee 2 gave his newly hired intern as an example. His intern was a graduate student from the Department of Architecture, who wanted to learn more about affordable housing and its process. Evidently, he demonstrated no understanding of building construction and budgetary factors. His suggestions for improvements on the construction site were all costly items, and no consideration of infrastructure to form a community was evidenced. With the exception of the architectural design professor, the other six (6) interviewees asserted that it should be as early as possible, starting from the first semester of the architecture school. However, the architects added that the building cost should be implied at the level of awareness, and the students’ design should not be cost-driven.

In a pursuit to find ways to include cost awareness in architectural design education, we asked the interviewers to suggest ways to improve cost awareness in architectural design education. All seven (7) interviewees suggested teaching the preliminary cost estimation at the conceptual level and building elements as basic inclusive strategies to introduce cost as a fundamental design determinant. They advocated that this was crucial. Working with student volunteers and design students for many years, the directors of the non-profit housing organizations indicated that they have witnessed significant differences in students’ design quality with or without the knowledge in the building elements. The local builder suggested in learning to research alternative materials and methods, thus later they would be able to convince the clients to cost efficient alternative to construct and also to discuss what they can do without and why.

Table 4: What means of methods would you suggest to improve cost awareness in architectural design studio education?

Participants	Response
Construction Science Professor	It would not be so easy. Basic cost estimation will be a good way to start... or collaboration with cost estimation class
NGOs in Housing	Learn to design with simple form and shape, and how to do cost estimation
Local Builder	Understanding what is conventionally available and also seek for alternatives
Architectural Design Professor	It should be pressed that we design to build
Architects	Look at life cycle of the house when designing.

The architects suggested that understanding building elements and their life cycle would suggest students to quantify items and understand dollar savings. Most importantly, student should develop to review their design critically from all angles. For an example, "...the windows are more expensive than solid wall, but it may bring environmental issues. What we typically expose can be covered up, but it could also be problem, because it reduces circulation" (Interviewee 6 personal communication, February 3, 2015). They also advocated that students should be imaginative, and learn to use rationale to convince the clients for better use of the budget. Then he brought up an example of a university project he did in Arizona. The client had fixed money, fixed circulation, fixed number of program, and fixed SF. There was no way for the designer to provide everything the client wanted under that budget.

During the charrette, they talked about the absolute needs for the faculty and students. Then found ways to share offices, and reduce air conditioned circulation spaces. Most of circulation happen outdoor reducing covered and air conditioned area.

Lastly, the interviewees shared their concerns on the current architectural education. Interviewee 1 raised his concern on the current architectural education that architectural education today is “too focused in preparing students to become artists rather than architects. They know nothing about how buildings are put together” (Interviewee 1 personal communication, December 18, 2014). Similarly, the two directors of nonprofit organizations stressed that architecture education is lacking the notion of one size does not fit all, especially when they are working on low-cost housing. They added that students must be aware of the context and where they are building. The architectural design professor stated that students are lacking the understanding of space – response to the way space is conceived. They should also recognize the premise of what generation they belong. Use of softwares –without the softwares, we many lose the ease of manipulation. The architects were concerned that the practical piece of puzzle is missing in the current architectural education system. “There is real understanding of how you live, and what is like to live in the space” (Interviewee 6 personal communication, February 3, 2015).

Another comment was that although different schools offer various curricular, public institutions’ “curriculum is very tight and there is no room for anything else. There are other courses beneficial to architecture as well – courses about just life. Similar to this response, Jarrett (2005) discusses blind spots in the design studio. According to his article, ‘Social practice: Design education and everyday life’, design education continues to represent design theory secluding the studio work from everyday life. The current design studio education portrays exclusion of people in the neighborhood and community. He applies an example of the coatmaker to an architect’s role in the society. The architect’s role is not to make the object-the building, but cultivates the sense of place. Jerrett attested design with attention to context, climate, space, movement, light, surfaces, codes, budgets, systems, materials and joints shall accomplish the goal in making a place.

SUMMARY

As we have seen, all seven (7) interviewees made voice over why early recognition of cost in design and construction is important to eliminate such risk that increases the possibility of trade-offs between quality and cost. Key informant interviews identified the needs and relevance of teaching cost as a fundamental design determinant and appropriateness in learning such concepts during the foundation design education. Regardless of their role in the architecture industry, most interviewees strongly felt that financial aspects of architecture and construction must be addressed as early as possible in the architectural education. Although they all agreed in the importance of teaching financial aspect of architecture, industry practitioners voiced strongly toward inclusion of cost as a part of the mainstream architectural principles. The interviewees also, presumed that introduction of such topic to young designers would bring long-term benefits of broadening the architectural market.

Teaching concepts of preliminary cost estimation was advised to understand building elements to further enhance affordable design. Another suggestion was to emphasize on simple designs, and understand what is conventionally available before seeking unique alternatives. Consideration of the concept of life cycle cost during design was also recommended. It was also emphasized that students should be imaginative, and learn to use rationale to convince the clients for the better use of budget.

All participants concluded that architectural education was missing the practical piece of puzzle. The result from the key informant interview also raises a common concern toward architectural education today. They were all concerned with the lack of practicality or social contribution of architectural design education. It is interpreted as that architectural education appears to be leaning toward promoting artist or design ideology, rather than educating socially responsible practitioners. Furthermore, it infers that with greater attention to formative ideologies, something as basic as understanding building assemblage is absent in design education. While a broad range of scholarly and intellectual inquiry is appreciated, fundamental educational approach is not challenged.

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