Interior Architecture Education Model at Bachelor's Level for Increasing Student Achievement in Design-Cost Control

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ABSTRACT

Interior renovation process has a complex structure due to its intrinsic conditions, the necessity of different sub-contractors' working together and the high number of components as regards manufacturing. It is extremely important to establish the relationship between cost and design in management of this process correctly. Different cost estimations are made at different stages of the process to this end. The experience of the designer is very important for reliable cost estimations. A designer experienced in cost estimation achieves high success in design-cost control estimation and manages the interior renovation process correctly. In this context, the purpose of the study has been determined as proposal of a new interior architecture education model at bachelor's level for increasing student achievement in design-cost control. A literature search has been conducted with an eye to determine what the cost estimation methods used at different stages of the design are at the first stage as methodology in line with this defined purpose and in this context, it has been determined what kind of cost estimations the interior architecture students should make at each and every stage of "Interior Architecture Design Studio" courses. Subsequently, it has been determined which information has to be provided to the students in theoretical courses in order to realize this cost -design relation practice described for project courses. At the final stage, an interior architecture education model at bachelor's level which integrates theoretical courses covering all of these educational activities with "Interior Architecture Design Studio" courses has been proposed.

Keywords: Interior architecture education, Interior architecture design studio, Cost management in interior architecture

INTRODUCTION

Interior renovation process has a complex structure due to its intrinsic conditions, the necessity of different sub-contractors' working together and the high number of components as regards manufacturing. Göktürk [1] has underlined the fact that the proper management of such processes will be possible only by providing the optimization of the quality, cost, and time trio and therefore reliable cost estimations are extremely important for the process to function properly. Marjiwe [2] mentions that correct cost estimations is the most important guide in quality, time and financial plannings in any types of projects. Butcher and Demmers [3] emphasizes in a way to support all these ideas that cost estimations are made for different purposes at different stages of the design and the interior designer who will make this estimate should have sufficient knowledge in this regard.

In this context Istanbul Technical University's (ITU), Interior Architecture Department's bachelor's degree program has been taken as the exemplary model within the study and it has been examined if information as to cost estimation and planning has been provided sufficiently to students in this program. To this end, firstly description and objectives of the

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courses named “Interior Architecture Design Studio I-II-II-III-IV” -given in Istanbul Technical University’s (ITU), Interior Architecture Department- in the course catalog forms have been examined.

Table 1. “Interior Architecture Design Studio” course descriptions and objectives

	Course Description	*Course Objectives*
Interior Architecture Design Studio I	Decisions concerning planning and programming which constitute data for interior architectural design; investigation of the relationships between terms such as function, form and technology through interior architectural design in different scales; analysis and evaluation of needs; holistic administration of the elements constituting the experience of interior space; conceptual research on interior architectural design, its formal expression and implementation; design of commercial interior spaces focusing on corporate identity such as retail stores, exhibition spaces, dining spaces, etc.; interior design related with domestic environments such as houses.	To develop concepts on interior design. To produce and develop solutions to the given problems of interior space design by considering logical and intuitive queries. To comprehend and evaluate the relationships between interior space and human needs. To examine interscale relationships in regards to elements of interior architectural environments. To conduct interior design in domestic contexts such as houses.
Interior Architecture Design Studio II	Decisions concerning planning and programming which constitute data for interior architectural design; investigation of the relationships between terms such as function, form and technology through interior architectural design in different scales; analysis and evaluation of needs; holistic administration of the elements constituting the experience of interior space; conceptual research on interior architectural design, its formal expression and implementation; design of commercial interior spaces focusing on corporate identity such as retail stores, exhibition spaces, dining spaces, etc.	To develop concepts on interior design. To produce and develop solutions to the given problems of interior space design by considering logical and intuitive queries. To investigate the issues of image and identity in interior architectural environments as design input. To design commercial interior spaces such as retail stores, exhibition spaces, dining spaces, etc. focusing on corporate identity
Interior Architecture Design Studio III	Decisions concerning planning and programming which constitute data for interior architectural design; investigation of the relationships between terms such as function, form and technology through interior architectural design in different scales; analysis and evaluation of needs; holistic administration of the elements constituting the experience of interior space; conceptual research on interior architectural design, its formal expression and implementation; design of service based, large-scale and multi-functional interior spaces such museums, hotels, clinics, offices etc.	To develop concepts on interior design. To produce and develop solutions to the given problems of interior space design by considering logical and intuitive queries. To investigate the issues of image and identity in interior architectural environments as design input. To design service based, large-scale, and multi-functional interior spaces.

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Interior Architecture Design Studio IV	Decisions concerning planning and programming which constitute data for interior architectural design; investigation of the relationships between terms such as function, form and technology through interior architectural design in different scales; analysis and evaluation of needs; holistic administration of the elements constituting the experience of interior space; conceptual research on interior architectural design, its formal expression and implementation; adaptive re-use of buildings qualified as historical and cultural heritage in accordance with contemporary needs, and the design of their interior spaces.	To develop concepts on interior design. To produce and develop solutions to the given problems of interior space design by considering logical and intuitive queries. To investigate the issues of image and identity in interior architectural environments as design input. To design interior spaces of buildings qualified as historical and cultural heritage through adaptive re-use.

The reason of evaluation of the courses named "Interior Architecture Design Studio" at the first stage is that these courses have the nature of representing the design process in which cost estimations are performed in practical life. As a result of these examinations within the purview of the courses named “Interior Architecture Design Studio I-II-II-III-IV”, it has been observed that neither application study nor student informing process as to cost planning has been included.

When the relation the courses named “Interior Architecture Design Studio I-II-II-III-IV” with program outcomes have been evaluated in a systematic way, it has been determined that none of these courses can be associated with “Costs**:** Know-how on building economy, cost estimation in design and manufacturing, planning and control” program outcome in a way to support the results in Table1.

Table 2(Part-I). Interior Architecture Design Studio I-II-III-IV” program outcomes

Program Outcomes	*Interior Architecture Design Studio I*			*Interior Architecture Design Studio II*			*Interior Architecture Design Studio III*			*Interior Architecture Design Studio IV*		
	1	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*
Critical Thinking Skill			X			X			X			X
Writing & Speaking Skill					X			X				
Personal Expression Skill				X			X					
Language Skill					X			X				
Graphic/Visual Representation Skill		X			X			X			X	
Interdisciplinary Coordination		X			X			X			X	
Teamwork Skill			X			X			X			X
Research Skill			X			X			X			X
Presentation Skill			X			X			X			X
Perception and Thinking Skill			X			X			X			X
Documenting and Archiving Skill		X				X			X		X	

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Table 2 (Part-II). "Interior Architecture Design Studio I-II-III-IV" program outcomes

Program Outcomes	*Interior Architecture Design Studio I*			*Interior Architecture Design Studio II*			*Interior Architecture Design Studio III*			*Interior Architecture Design Studio IV*		
	1	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*	*1*	*2*	*3*
Basic Design and Expression Skill			X			X			X			X
Design Skill			X			X			X			X
Transferring Theoretical Knowledge to Design Skill		X			X			X			X	
Factors Effecting Design		X			X			X			X	
Human Behavior		X			X			X			X	
Form and Space		X			X			X			X	
Material					X			X				
Colour and Light					X			X				
Lighting					X			X				
Textile					X			X				
Furniture					X			X				
Interior Architecture History and Theory Historical Environment and Adaptive Re-Use												
Building and Construction Systems		X			X			X			X	
Professional Progress												
Legal Responsibility												
Professional Practice												
Costs: Know-how on building economy, cost estimation in design and manufacturing, planning and control												
Ethics				X			X					
Management and Organization												
Leadership and Executive Role												
Relationships with Customers												

The compulsory courses to be taken during four years have been examined in the next phase of the study with a view to determine if there are any other lessons aiming the students to gain cost estimation skills in addition to the courses named "Interior Architecture Design Studio I-II-II-III-IV" and it has been observed that there is a single course named "Cost Management in Interior Architecture" to that effect.[4].

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Table 3. Interior Architecture Department Bachelor's Level Courses

Interior Architecture Department Undergraduate Program Courses	
Basic Design and Visual Arts	Architecture Design Studio II and Advance Representation Techniques
Mathematics	Architecture Design Studio I and Representation Techniques
Statics	Architecture Design Studio III
English Course I-II-III	Interior Architecture Design Studio I-II-II-III-IV
Turkish I-II	Graduation Project
History of Architecture I-II-III	Introduction to Building Construction
Architectural Survey	Strength of Materials
Architectural Design Theory	Building Construction Methods
Intr. to Comp. and Information Sys.	Principles of Loadbearing Structures
Adv. Representation Techniques	Building Element Design
Building Materials I-II	Environmental Control Studio I-II
Furniture Design	Economics
History of Turkish Revolution I-II	*Cost Management in Interior Architecture*
Professional Practice and Ethics	

When the course catalogue form of this course intended to explain the content of the course named "Cost Management in Interior Architecture" was evaluated, it was determined that the course was provided fully independently from the courses named “Interior Architecture Design Studio I-II-II-III-IV” and the course was mainly given in a theoretical way and the students only made application works as to the "Unit Price Estimate" method used at the final stages of design.

It has been observed as a result of all examinations that the educational model of Istanbul Technical University’s, Interior Architecture Department taken as an exemplary model within the study does not have a structure that allows the students to acquire skills for establishing cost-design relation correctly.

PURPOSE AND METHODOLOGY

The purpose of the study has been determined as proposal of a new interior architecture education model at bachelor's level for increasing student achievement in design-cost control. A literature search will be conducted with a view to determine what the cost estimation methods used at different stages of the design are at the first stage as methodology in line

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with this defined purpose and in this context, it will be determined what kind of cost estimations the interior architecture students should make at each and every stage of "Interior Architecture Design Studio" courses. Subsequently, it will be determined which information has to be provided to the students in theoretical courses in order to realize this cost-design relation practice described for project courses. At the final stage, an interior architecture education model at bachelor's level which integrates theoretical courses covering all of these educational activities with "Interior Architecture Design Studio" courses will be proposed.

Determination of Cost Estimation Methods Utilized at Different Stages of Design

Estimating methods may vary by type and class of estimate. The method used for most definitive estimates is to fully define and understand the scope, take off or quantify the scope, and apply costing to the scope, which can then be summed to a total cost. Proper documentation and review are also important. Early estimates may employ various means of cost modeling. The basic characteristics of effective estimating include: clear identification of task, broad participation in preparing estimates, availability of valid data, standardized structure for the estimate, provision for program uncertainties, recognition of inflation, recognition of excluded costs, independent review of estimates, and revision of estimates for significant program changes. Application of best practices helps ensure a high-quality estimate. Certain best practices should be followed if accurate and credible cost estimates are to be developed. These best practices represent an overall process of established, repeatable methods that result in high-quality cost estimates that are comprehensive and accurate and that can be easily and clearly traced, replicated, and updated [5].

To determine how costs change with measurable efficiency factors has a vital importance for decision-making, planning and control processes. Preparation of budget and performance reports, calculation of standard costs, determining associated costs for pricing decisions, management of costs and all of the other decisions are based on reliable cost estimations and determination of costs at the different levels of activity [6]. The designer makes different cost estimations at different phases of the projecting process and makes revisions to adjust design decisions according to the budget when the budget is exceeded.

Literature researches have been conducted at the first phase of the study with an eye to determine the cited cost estimation methods. As a result of these researches it has been seen that the cost estimation methods are collected under four main groups based on the content of the information related to the project [2; 3; 7; 8; 9; 10;11; 12; 13; 14; 15]. These methods that serve the same purpose under each group are expressed by different names as follows:

i. Group: Preliminary estimate, ballpark, blue-sky, seat of the pants, order of magnitude, approximate estimate, abstract estimate, rough cost estimate,

ii. Group: Square foot estimate, cubic estimate, plinth area estimate,

iii. Group: Conceptual, assembly and system estimate,

iv. Group: Unit price estimate

Early in the planning stages of a project, both owner and designers need and often demand an indication of the cost of the project at completion. One of the most purposes these preliminary estimates are to provide information to an owner or client so that a decision can be made to proceed with the project. Square foot estimate is another method of developing a preliminary estimate based on historical data. This technique is effective in preparing advances preliminary estimates when features of proposed project are known, but not yet designed. Conceptual, assembly and system estimate is groups of work of several trades combined into a single cost element. For example, renovation of a bathroom may require

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plumbers, electricians, tile setters and carpenters. The assembly cost includes the cost of participation from each trade, including materials. Unit price estimate can be prepared when the design and contract documents have been completed or are essentially complete [7].

It will be aimed to teach the theoretical information related to cost estimation methods described above and strengthening them with a variety of applications to be conducted in the interior design project course in the interior architecture education model at bachelor's level which will be proposed within the purview of the study. The time required for the calculation correctly by these cost estimation methods defined in four main groups are as shown in Table 4 [7]. The information as to time in Table 4 shall be considered during creation of the 14-week course program and sufficient time will be provided in order that the students can learn and use these methods within the scope of the course.

Table 4. The time required for making reliable estimates by virtue of cost estimation methods

Group	*Cost Estimating Method*	*Duration*
I	Preliminary Estimate	Hours
	Ballpark	
	Bluesky	
	Seat of the Pants	
	Order of Magnitude	
	Approximate Estimate	
	Abstract Estimate	
	Rough Cost Estimate	
II	Square Foot Estimate	Hours-Days
	Cubic Estimate	
	Plinth Area Estimate	
III	Conceptual	Days
	Assembly and System Estimate	
IV	Unit price estimate	Weeks

It will be determined what the theoretical information the students need to acquire have to be so that they can have a sufficient level of command of managing the cost estimations identified in Table 4 within the interior architecture education process at the next phase of the study.

The theoretical information the students need to acquire so that they can have a sufficient level of command of managing the cost estimations within the interior architecture education process

A literature research has been conducted to determine the necessary information to be provided in the “Cost Management in Interior Architecture” course so that the cost estimation methods collected under four main groups can be used properly and in line with its purpose within the purview of interior architecture project courses and the results obtained have been

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presented in Table 5 as topics and contents of the courses [2; 3; 7; 16; 17; 18; 19; 20; 21; 22; 23; 24].

Table 5. "Cost Management in Interior Architecture" course topics and course descriptions

Course Topic	*Course Description*
Cost estimation in interior architecture and the importance of cost control	Design phases in interior architecture, the importance of cost estimation and control at these phases, basic concepts as to cost management and etc.
Information classification systems and the relation thereof with the cost	Master Format, Uniformat, etc.
Factors affecting the cost in interior architecture	Location, when the renovation will take place, time needed for completion of the renovation, quality, type of renovation, time allotted for cost estimate, scope of project, site conditions, project complexity, market conditions, work area Access, complexity of space, style, changing expection of the owner along the course of project, real estate in building area, project scheduling, age of the building, work by owner, the amount of curvilinear forms of design, season/climate, trustworthy tradesmen, terrain, contingencies/unexpected, etc.
Group cost estimation methods	Preliminary estimate, ballpark, bluesky, seat of the pants, order of magnitude, approximate estimate, abstract estimate, rough cost estimate, etc.
The required data sources for usage of group cost estimation methods	Cost data for comparable completed projects, Location cost Index, Historical cost index, etc.
Intended use of results of group cost estimation methods	Information to an owner or client so that a decision can be made to proceed with the project, etc.
Application as to use of group cost estimation methods	I application work using group cost estimation methods.
Group cost estimation methods	Square foot estimate, cubic estimate, plinth area estimate, etc.
The required data sources for the use of group cost estimation methods	The type of building or facility and the proposed number of square feet. Other unit measures such as the number of beds for a hospital, etc. Cost data books provide square foot and other unit costs for a variety of buildings, Location cost Index, Historical cost index, etc.
Intended use of the results of the group cost estimation methods	For preparing advanced preliminary estimates when features of the proposed project are known, but not yet designed, etc.
Application as to use of group cost estimation methods	Application work using group cost estimation methods.

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Group cost estimation methods	Conceptual, assembly and system estimate
The required data sources for usage of group cost estimation methods	Assemblies| are groups of the work of several trades combined into a single cost element. For example, construction of a bathroom may require work by plumbers, electricians, tile setters, and carpenters. The assembly cost includes the cost of participation from each trade, including materials, Location cost Index, Historical cost index, etc.
Intended use of the results of the group cost estimation methods	For saving time and improving accuracy for companies doing repetitive work on the same types of projects.
Application as to use of group cost estimation methods	Application work using group cost estimation methods.
Group cost estimation methods	Unit price estimate
The required data sources for the use of group cost estimation methods	Unit cost price, Location cost Index, Historical cost index, etc.
Intended use of the results of the group cost estimation methods	For preparing budgets and evaluating bids for the project etc.
Application as to use of group cost estimation methods	Application work using group cost estimation methods.

Proposal for Interior Architecture Education Model at Bachelor's Level

Integration of the courses named “Cost Management in Interior Architecture” and “Interior Architecture Design Studio I-II-III-IV” has to be achieved in order that interior architecture undergraduate students can make accurate cost estimations at different stages of the design and be able to perform making any kind of decisions, planning and controlling related to the project process in this context. For this purpose, revision of the assignment of compulsory vocational courses in the bachelor’s degree to semesters as shown in Table 6.

Giving the "Cost Management in Interior Architecture" course in the 3rd semester will enable the students to receive the necessary theoretical information on cost estimation and planning as seen in Table 6. Before they start taking "Interior Architecture Design Studio" courses and perform a number of application works where they can use this information.

And this will enable the students to make different cost estimations at different stages in "Interior Architecture Design Studio I-II-III-IV" courses which begin in the 4th semester and continue throughout the undergraduate education and ensure that students can make works such as making the design decisions according to the budget in a more accurate way. In this direction, cost estimation studies which are recommended to be applied in parallel to the

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project studies by the students in "Interior Architecture Design Studio I-II-III-IV" courses and the place of these studies within the 14-week course program is recommended to be as stated in Table 7. The time needed to perform reliable estimates by cost estimation methods in Table 4 were considered when this proposal was made.

Table 6. Assignment of mandatory vocational courses in the bachelor's degree to semesters

Semester	*Compulsory Courses*	*Semester*	*Compulsory Courses*
I	Architecture Design Studio I and Representation Techniques	II	Architecture Design Studio II and Advance Representation Techniques
	Basic Design and Visual Arts		History of Architecture I
	Statics		Introduction to Building Construction
			Strength of Materials
III	*Cost Management in Interior Architecture*	IV	*Interior Architecture Design Studio I*
	Architecture Design Studio III		Architectural Survey
	History of Architecture II		Building Materials II
	Building Materials I		Mimari Tasarım Kuramları
	Building Construction Methods		Building Element Design
	Principles of Loadbearing Structures		
V	*Interior Architecture Design Studio II*	VI	*Interior Architecture Design Studio III*
	History of Architecture III		Furniture Design
	Environmental Control Studio I		Environmental Control Studio II
	Economics		
VII	*Interior Architecture Design Studio IV*	VIII	Graduation Project
	Professional Practice and Ethics		

In summary, it is recommended to assign the compulsory vocational courses in the interior architecture education model at bachelor's level to semesters as shown in Table 6. Accordingly the purview of the course named "Cost Management in Interior Architecture" in which theoretical knowledge related to cost estimate will be given must be as shown in Table 5. "Interior Architecture Design Studio I-II-III-IV" courses should be configured basing on the 14-week course curriculum as shown in Table 7 in order that skills to use these theoretical knowledge in practice can be acquired.

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Table 7. Cost estimation studies proposed to be applied in parallel with project works by students in the "Interior Architecture Design Studio I-II-III-IV" courses

Weeks	*Topics*	*Applications to be made as to cost estimation and planning within the scope of the relevant course,*	*The time to be allocated for relevant applications as to cost estimation and planning within the scope of the course*
1	Explanation of topics and concepts related with the topics.		
2	Field Trip-to analyze and comprehend the existent interior architectural environment		
3	Making preliminary studies: determination of user requirements, creation of the requirement program, and etc.	I. Making cost estimations of the project by using group cost estimation method and determination of the budget	Munites
4	Explanations on conceptual design- scenario-space relations and space setup		
5	Jury: Presentation and evaluation		
6	Schematic design-sketching, schematic resolution	II. Making cost estimation of the project by using group cost estimation method and making revisions to adjust design decisions according to the budget when the budget is exceeded.	Hours
7	Jury: Conceptual evaluation		
8	Design development studies- plans, sections, elevations (1/50)	III. Making cost estimations for a part of the project by using group cost estimation methods	Days
9	Design development studies- plans, sections, elevations (1/20)		
10	Design development studies – plans, sections, elevations and 3 dimensional models (1/20)		
11	Jury: Presentation and evaluation		
12	Design resolution studies – plans, sections, elevations ,detail design, 3 dimensional expression studies, final selection of materials	IV. Making cost estimations for the manufacturing in a part of the project by using group cost estimation methods	Weeks
13	Expression and presentation studies: 3 dimensional expression studies, presentation board design, material boards,		
14	Final Jury		

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RESULTS

The knowledge acquired by the students on cost estimation, planning and control will be strengthened by using them by making practice in "Interior Architecture Design Studio" courses thanks to the interior architecture education model at bachelor's level proposed within the scope of the study which significantly will increase the student's achievement will be possible in design-cost control.

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