Integrating Building Information Modeling (BIM) into Architectural Education: Pedagogical Challenges and Future Prospects: Case Study: Tartus University

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Abstract

This study investigates the challenges hindering the integration of Building Information Modeling (BIM) into architectural curricula in Syria, particularly at Tartus University. Despite growing industry recognition of BIM's benefits, academic institutions have exhibited initial resistance. The study analyzes existing BIM curricula, compares them to global benchmarks, and identifies key obstacles such as weak industry-academia links, insufficient resources, traditional teaching methods, and a lack of BIM expertise among faculty. To address these challenges, the study proposes a framework that includes strengthening industry-academia partnerships, enhancing financial and technical support, updating curricula and pedagogy, investing in faculty development, and establishing BIM centers of excellence. By implementing these strategies, Syrian universities can effectively integrate BIM into their curricula, bridging the gap between academia and the professional architectural community.

Keywords: Architectural education; Building Information Modeling; Integrated Design Studio; Architecture Engineering Construction.

PBL: Project _ Base Learning; Challenges

1. Introduction

The surveys show that the BIM system needs to be implemented in universities urgently. However, current research focuses mainly on the potential benefits of BIM accreditation across different sectors, such as student learning, architectural design, construction and investment management.

Many studies on BIM implementation in universities use a project-based integrated design studio approach, often referred to as PBL project-based learning and while valuable, they often face challenges in expanding their accreditation to the enterprise. This is due to the lack of a comprehensive analysis of institutional challenges to the adoption of BIM.

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These challenges can vary greatly across different universities and include factors such as limited resources, inadequate infrastructure, resistance to change, and inadequate faculty training. Thus, there are few practical plans and strategies designed to address the realities of the construction sector, particularly in difficult environments such as Syria, which faces many challenges in the public and private sectors.

Based on the importance of the next phase in Syria, the need to open up all the developments in the world of construction, and the fact that many companies are beginning to adopt modelling building information, which is inevitably increasing, educational institutions need to develop their curricula to keep pace with the digital transformation and qualify new graduates with the competencies needed for the local and global labour market. This requires special study and analysis of current and foreseeable obstacles to building information modelling being part of future architects' educational process, especially architects.

Therefore, all obstacles covered by previous studies and their impact on Syria must be examined and possible additional and new local constraints identified to overcome. This is what the current research will provide. The obstacles to the inclusion of BIM in architectural education from other people's experiences and local experiences will be analyzed, and appropriate solutions will be proposed.

2. Background:

The overarching objective of the development of architectural education is to link it to the labour market; To provide a professional cadre competent in the field. However, the time factor is an impediment to achieving goals and determining the accuracy of results; Because the time of labour market development outputs differs from the time of insertion at the school stage, where labour market standards may differ, and therefore it is important to maintain a continuous follow-up to these standards for application in academic study.

This is to achieve a mutually positive impact between academic study and professional reality. Transforming traditional education into advanced education with computer techniques, without negatively affecting the academic standards of architectural educators of academic institutions, and here comes the importance of including BIM in the academic curriculum as the most prominent digital technology for which the world of the construction industry is currently oriented.

Research Problem:

There are contradictory views on "if" and "how" BIM should be integrated into architectural education and the way it should be taken either as a program, as a process or in any composition of the academic curriculum structure.

Previous studies have presented different types of BIM challenges in architectural education but remain inclusive and incomplete.

There is still no plan for schools and architectural institutions on how to adapt to industry challenges and educate architects innovatively, so BIM is not taught in most architectural departments [4], while those who use BIM for education often rely on only 2D and 3D modelling.

Academic research to date has focused on the development of BIM curricula, interdisciplinary classroom environments and project-based learning, but there is little towards the development of BIM learning techniques [3]

The importance of research:

Despite the growing trend of BIM research in the AEC curriculum, however, there is little BIM research that relates to issues of institutional adoption of BIM architectural education

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based on a study of the reality and challenges of success of this process in each institution or country in general or independently.

Education will play a key role in future levels of success. Therefore, constant courses of continuous changes in educational patterns and curricula must be prepared. Therefore, urgent steps must be taken to pave the way for unifying solutions for the inclusion of BIM in academic curricula in a manner commensurate with the type of challenges that exist in each architectural school or educational institution, to provide students and graduates with the necessary scientific and practical skills and qualifications to enter local and global labour markets in order to build a high-level architectural generation with a comprehensive understanding of the construction industry's many and different aspects.

Research Objectives:

• Provide an overview of basic strategies for adopting and integrating BIM as a method and technology into architectural education and identify and analyze the most significant challenges of these methods locally and globally.

• Develop a proposed framework for integrating BIM into architectural education commensurate with today's reality challenges.

• Identify some key points to be considered for success in this transformative process.

Literature review: Overview:

Table 1: Documentation of reference studies and their relevance to research topic, Source: Author.

Study Number	Study title	Reference and Year	country	Approved strategy for inclusion of BIM	relevance
1	Challenges of Integrating BIM in Architectural Education	Building Information Modelling - Volume 2 - Computation and Performance - eCAADe 31	Liverpool United Kingdom	Offers a framework for the gradual adoption of BIM and integrated design in architectural curricula	Mimics the topic and reviews some of the challenges of incorporating BIM into the curriculum
2	Challenges and Solutions of BIM Integrated Architectural Education towards Construction	Fifth CU Building Conference (CCC2021, Coventry, UK, March 17, 2021)	United Kingdom	The review on integrated architectural education BIM towards CfE focuses on people, products and processes and integrates CfE principles into architectural education	Mimics the topic of research
3	A Systematic Review of Current Strategies and Methods for BIM Implementation in the Academic Field [2]	MDPI Published: 15 June2021 [2]	Spain	Systematic review of current strategies and methods for implementing BIM in academia Integrated Design Studio and PBL	Relatively compatible with the theoretical framework under consideration only
4	BIM and the future of architecture teaching	IOP Conference Series: Earth and Environmental Science (2022)	Brazil	Analysis of the potential of BIM Domain Model Uses as an alternative to establishing a pathway for the inclusion of BIM in the university teaching	Not focused on challenges

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				process of architecture of a Brazilian college	
5	CHALLENGE OF TEACHING BIM IN THE FIRST YEAR OF UNIVERSITY	20th International Society for Computer Assisted Architectural Design Research (CAADRIA) Conference 2015 in: Daegu, South Korea	Rangsett, Batothani, Thailand	Introduce BIM into the first-year architectural design curriculum as a tool and as a new way to practice design at the Architecture College in Rangsett and propose how to improve the curriculum	Relatively consistent: identify problems encountered in the chapter and typical misconceptions about the BIM approach based on their experience
6	BUILDING INFORMATION MODELLING IN ARCHITECTURAL EDUCATION: CONTRIBUTION OF BIM IN DESIGN PROCESS	Article in Turkish Online Journal of Art for Design and Communication· October 2020	Turkey	The paper analyses BIM's contribution to the design process, improved design capabilities and the contribution of BIM programmes to the curriculum	Don't focus on challenges
7	Students' perceptions of BIM learning scenario in architectural education	ITU A 'Z Vol. 17 No. 3 • November 2020 • 195-209		Strategy for exchange of experiences between the academic world and practice. Prioritize the self-learning approach and focus on students	It does not focus on challenges but rather illustrates students' perceptions of a learning scenario
8	. Teaching BIM and Its Impact on Young Professionals	(2020) [11]	Rio de Janeiro	This work is part of a larger objective of integrating ICF and BIM into the school curriculum and developing an alternative curriculum	They demonstrate challenges and successes in the approach adopted through an analysis conducted with students by surveys in the form of an interview
9	Introduction of building information modeling in industrial engineering education: Students' perception	(2019) [10]		Compulsory training in the second year of all degrees in industrial engineering; Second, optional specialized training in the fourth year of different grades and mandatory training in a single degree programme	Emphasize the need to continue evaluating future courses to test the validity of their proposals rather than challenges
10	BIM laboratory exercises for a MEP systems course in a construction science and management program	(2016) [9]		Modify BIM integration curriculum to include BIM in construction and management sciences	Focus on outcomes related to students' perception of learning BIM rather than challenges

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3. Critical review of previous literature:

Through surveys, the need to implement BIM in universities emerges, as most studies focus not on analysing the obstacles to the success of their BIM listing plans but on studying the implications of applying the strategy itself, both to students, the architectural design process, the construction industry, aspects of investment management and others. Most studies follow the strategy of the project-based integrated design studio or Learning PBL and still face difficulties in generalizing their experiences and putting their proposals under ongoing implementation because they face difficulties in adopting the new approach in the student, the institutional level due to lack of adequate analysis of current and renewed barriers and study of challenges that remain inclusive and varying from place to place. Thus, there are very few plans of action and strategies designed to deal with reality and its challenges and propose appropriate solutions, especially in engineering environments like the reality in Syria and full of public and private challenges. This is what our research will be interested in.

It is essential that people who implement BIM at the university have a curriculum based on coherent principles aimed at improving the acquisition of student competencies through BIM methodologies based on the study, analysis and follow-up of current and emerging public and individual barriers and challenges, which can stand in the way of the success of this task to reduce, mitigate or make the necessary changes to ensure the attainment of the goal. The impact of various types of challenges and the discovery of current challenges will be examined locally, thus identifying some general principles to help integrate information management into school curricula and then submitting proposals for a curriculum commensurate with the realities and challenges of the current state of the study and general challenges

Research methodology:

This research methodology was grounded in a thorough review and analytical curriculum of previous studies and experiences in the field of inclusion of BIM in the academic curriculum of engineering colleges was followed and emphasis was placed on scientific articles and research papers that considered the latest approaches.

This study comprehensively analyzed the challenges faced by engineering and architectural educational institutions worldwide in integrating BIM into their academic curriculum. These challenges were categorized and analyzed based on their type and impact.

The questionnaire on the practical aspect of the study was then built on our conclusions from the theoretical aspect, analyzing its findings and then building on the above in making proposals for the inclusion of BIM in academic curricula commensurate with current realities.

Some strategies adopted globally to include BIM in academic curricula:

A recent study suggests that universities lag the AEC industry in terms of adopting BIM techniques and improving cooperative work, and that universities currently do not meet industry needs in terms of cooperative building design and BIM education.

Most developments in the UK relate to the emergence of new courses in BIM and integrated design as well as CPD courses, where quick approach options and focused content, are usually oriented to a multidisciplinary audience and therefore require general content. They do not usually address individual challenges and often aim to provide an "introduction" to the topic [6].

There are very few adventurous institutions whose BIM already forms part of their curriculum, although it is not in line with the rest of the traditional content.

BIM-integrated design studios have also become an experimental and safe option in

introducing BIM into the curriculum, which is implemented in both UG and PG studios.

Doi: https://doi.org/10.54216/IJBES.100203
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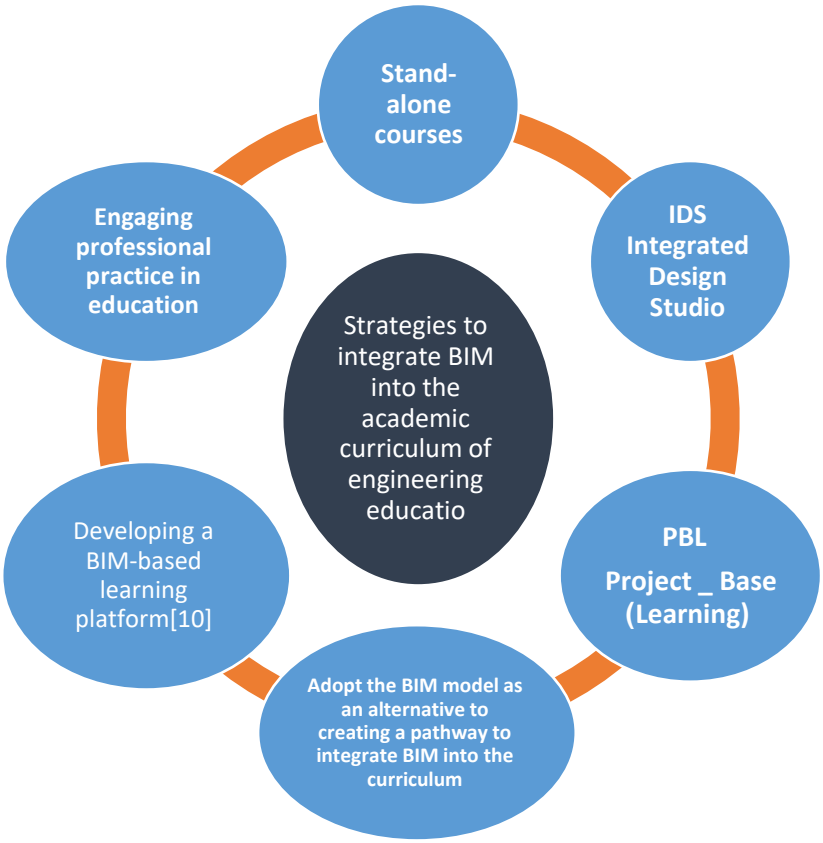

Figure 1: Some globally adopted strategies for integrating BIM into the academic curricula of engineering and architectural colleges, Source: Author.

Table 2: Evaluation of strategies for the inclusion of BIM in the academic curricula of engineering colleges, Source: Author

Strategy	Features	Negatives
Stand-alone courses	Help students acquire modeling skills to reach an expert degree in using BIM tools Offering BIM tools to ACE architecture, engineering and construction student	The student may not be at an appropriate level of experience It will not achieve the hoped-for level of cooperation
IDS Integrated Design Studio	Assists students from multidisciplinary disciplines to understand the workflow and give them a holistic understanding of the construction industry AEC. And acquiring knowledge of how to do a project on the ground	A prerequisite for successful "integrated design" is that "each specialization should become more skilled in what it does, respecting and appreciating each other's contribution as a first step towards new work processes"

Doi: https://doi.org/10.54216/IJBES.100203
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PBL **(Project _ Base Learning)**	Knowledge of students' motivations and satisfaction with the use of BIM methodologies Getting the awareness of students, teachers, researchers and even industry professionals, making comparisons between different universities.	Implementation in AEC certificates affects the entire curriculum and is a time-consuming process as it affects different cycles
Adopt the scope of the BIM model as an alternative to creating a pathway to integrate BIM into the curriculum	BIM can be introduced into bachelor's courses in architecture through (BIM Model Uses) 'The BIM system can be introduced from the beginning of the course, especially the contents related to: capture, representation, simulation, quantification, monitoring, control and after the first course, students will be willing to continue exploring the uses of BIM for planning, design, construction, manufacturing, operation and maintenance	It depends on the motivation of students and professors to integrate and explore alternatives. It will be necessary to develop new mindsets and attitudes among professors, students, and therefore professionals. Without mastering "architecture" it will not be possible to master the BIM process
Developing a BIM-based learning platform (interactive books and a model environment to link BIM and AEC education[1]	Integrate easy-to-use online learning platforms where students can learn at their own pace, practice their skills, and improve engagement and learning. Students can move bi-directional between models and textbooks, or even between relevant models and textbooks and other sources associated or embedded from the InBookModE interface	Because there are many BIM programs, each with its own solutions, implementing a learning system that can be included in different BIM software applications is a challenge
Engaging professional practice and relying on students' self-learning with academic guidance	Opportunity to communicate directly with architects and engineers from other disciplines and their openness to share their experiences Practice mentors have a lot more knowledge about BIM than teachers in general and more convincing because they use the	Students need more time to learn the tool so they can follow up and understand what was shown in the class New BIM tools, it took time to rest on their use. Many students will return to the "safest option" of using the tools in which they are more proficient

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	example to support what they say and are full of real-life stories Students can learn technical skills more efficiently in the self-learning approach rather than the classical trainer-led approach	

General challenges of including BIM in AEC curricula

The introduction of BIM into architectural education in particular, and engineering in general, has faced many obstacles limiting the full implementation of BIM education and it is natural that the integration of any usually emerging technology will be challenged during the process of developing a university program. The expectations and need of BIM teachers and teachers to be able to respond to emerging trends, along with the breadth of topics to be covered in typical BIM courses, provide the scale of challenges for academics offering such courses. The overall challenges will be grouped and summarized as follows based on these experiences, studies and the above.

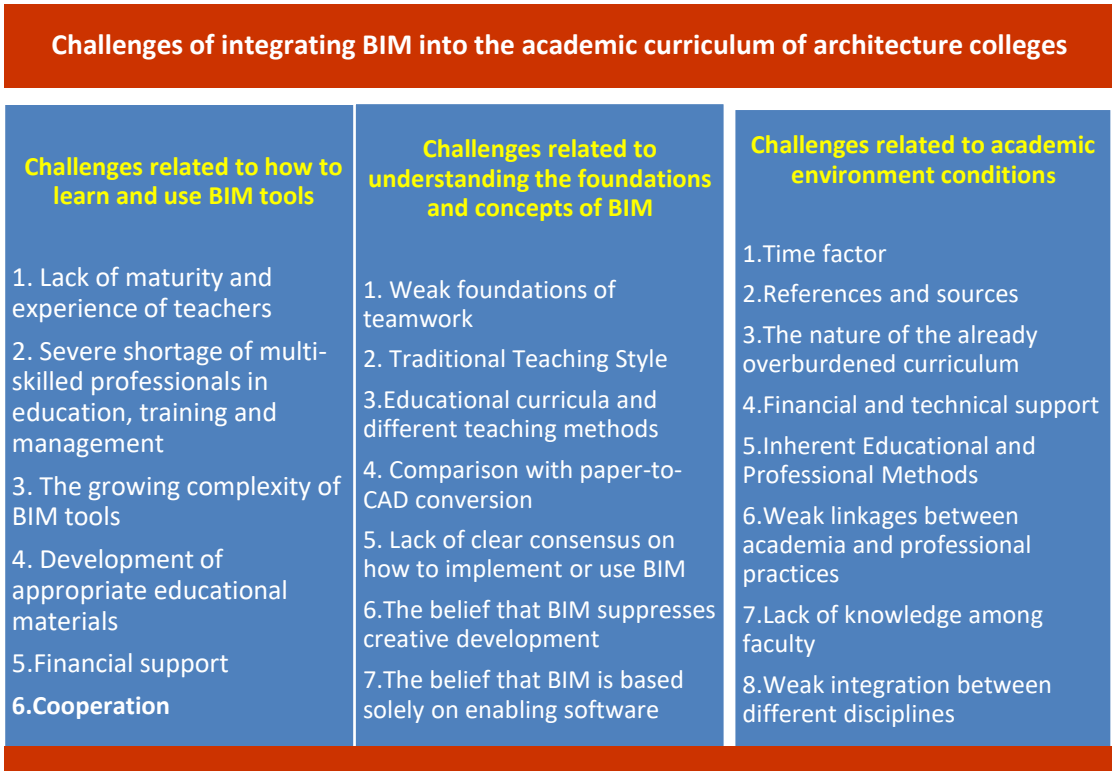

Figure 2: Challenges of integrating BIM into the academic curricula of architecture faculties, Source: Author based on [7][8].

Practical part of the study (questionnaire):

The questionnaire conducted consists of a first demographic information segment and then three main axes and each axis consists of several questions:

• First theme: Challenges related to the nature of the academic environment, consisting of 7 questions.

Doi: https://doi.org/10.54216/IJBES.100203
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• Part II: Challenges related to understanding the foundations and principles of BIM and completing 5 questions.

• Part III: Challenges related to the method of learning and using BIM tools and consists of 5 questions.

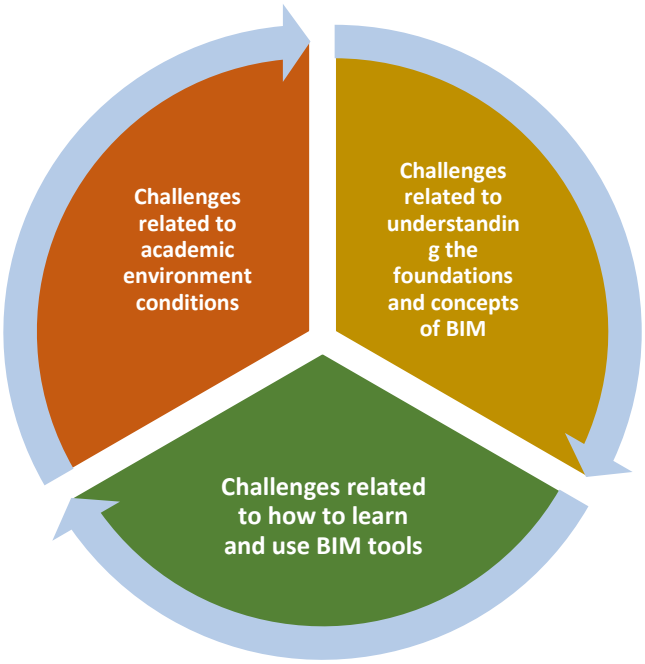

Figure 3: Main questionnaire parts, Source: Author based on [16].

• The last question from the open-ended questionnaire was to learn researchers' opinions and draw on their expertise and experiences (in your view are you proposing other additional challenges that impede the inclusion of BIM in the academic curricula of architecture colleges?)

The questionnaire was distributed to the research sample of 54 graduates of the Architecture College of Tartus, its teaching staff, BIM master's students, professors and other architects in the labour market.

The answer of the three main axes of research was renewed as closed questions and based on multiple selection using the LIKERT pentameter (each number corresponding to the degree of impact) as follows:

Response	Never impactful	Ineffective	Neutral	Influential	Very influential
Grade	**1**	**2**	**3**	**4**	**5**

This is to determine the degree to which each type of challenge affects the process of incorporating BIM into the academic curricula of engineering and architecture faculties.

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Case Study: (Faculty of Architecture _ Tartus University)

Tartus University is a state university located in the city of Tartus in Syria. It was announced by Decree No. 2 of 2015, having been part of the University of Titrine and still considered a new college, the first batch of architects graduated in 2021.

The results of the questionnaire were analysed according to the type of challenges, the degree of their impact and the number of responses to each type by the research sample. It was found that the most influential challenges to the process in our local case-specific study range were challenges related to the nature of the academic environment. As shown in the following Table:

Doi: https://doi.org/10.54216/IJBES.100203
Received: September 21, 2024 Revised: December 02, 2024 Accepted: January 04, 2025

Table 3: Table showing the number and type of questionnaire responses, Source: Author

		Number and type of responses				
Challenge Number	**Challenges**	Very influential	Influential	Neutral	Ineffective	Never impactful
6	Weak linkages between academia and professional practices	22	21	5	3	3
4	Availability of necessary financial and technical support	24	17	7	2	4
5	Adherence to traditional teaching methods and lack of knowledge of BIM among faculty members	26	11	9	5	3
3	The nature of curricula actually overloaded with materials	19	17	10	5	3
15	There is a severe shortage of multi-skilled professionals to help with education	18	18	10	5	3
17	Use of BIM software is limited to 3D modeling	10	26	11	6	1
11	Weak foundations for teamwork and cooperation	13	24	8	4	5
14	Failure to develop appropriate teaching materials	8	29	10	5	2
9	Different and diverse educational curricula and methods of education from one place to another	12	26	6	5	5
2	Insufficient references in teaching BIM	10	20	14	7	3
1	Time factor and timing for inclusion of each information level	6	25	13	7	3
8	Lack of clear consensus on how to implement and use BIM	8	20	16	8	2
7	Poor vertical and horizontal integration in education management in AEC curricula	8	19	15	11	1
16	Failure to consider students' individual aspects and skills	8	17	20	7	2
13	The growing complexity of BIM tools	6	20	19	6	3
12	The belief that BIM suppresses the creative development of the architectural student	8	10	21	14	2
10	Believing that BIM is based solely on software	4	14	23	9	4

Doi: https://doi.org/10.54216/IJBES.100203
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Table 4: Table showing quantitative analysis of questionnaire results, Source: Author

	5	4	3	2	1					
Challenge Number	Very influential	Influential	Neutral	Ineffective	Never impactful	Arithmetic Average	Standard Deviation	Ratio	Sample Direction	Challenge Rank
6	22	21	5	3	3	4.04	9.81	80.7	Ineffective	1
4	24	17	7	2	4	4.02	9.36	80.4	Ineffective	2
5	26	11	9	5	3	3.96	9.07	79.3	Ineffective	3
3	19	17	10	5	3	3.81	7.09	76.3	Ineffective	4
15	18	18	10	5	3	3.80	7.05	75.9	Ineffective	5
17	10	26	11	6	1	3.70	9.36	74.1	Ineffective	6
11	13	24	8	4	5	3.67	8.17	73.3	Ineffective	7
14	8	29	10	5	2	3.67	10.62	73.3	Ineffective	8
9	12	26	6	5	5	3.65	8.98	73.0	Ineffective	9
2	10	20	14	7	3	3.5	6.53	70.0	Ineffective	10
1	6	25	13	7	3	3.44	8.73	68.9	Ineffective	12
8	8	20	16	8	2	3.44	7.16	68.9	Ineffective	11
7	8	19	15	11	1	3.41	6.87	68.1	Neutral	13
16	8	17	20	7	2	3.41	7.46	68.1	Neutral	14
13	6	20	19	6	3	3.37	8.04	67.4	Neutral	15
12	8	10	21	14	2	3.20	7.07	64.1	Neutral	16
10	4	14	23	9	4	3.09	7.98	61.9	Neutral	17

Based on the analysis of research participant responses, the most influential challenges to the inclusion of BIM in the academic curriculum locally can be summarized as follows:

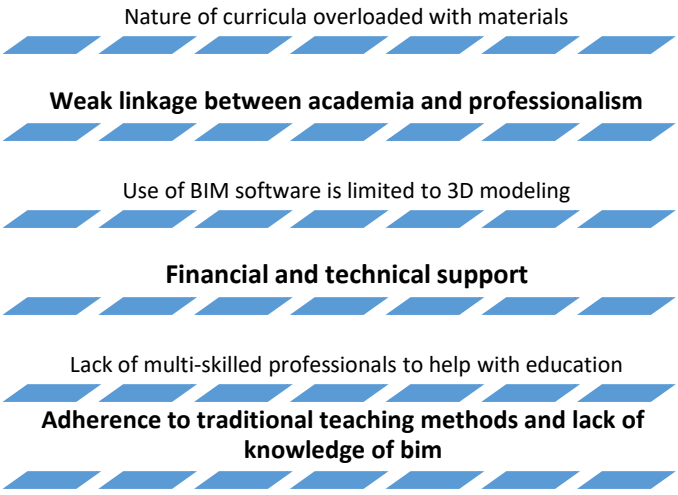
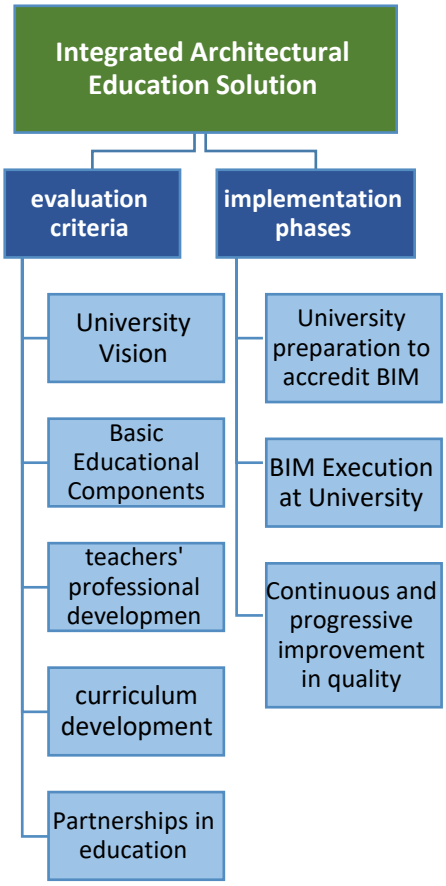


Figure 4: Most influential challenges depending on the research sample response rate, Source: Author

The following format illustrates some of the most prominent answers of the research sample to the last question of the questionnaire on the existence of additional challenges from their experience and compares local challenges in Syria with global challenges.

Doi: https://doi.org/10.54216/IJBES.100203
Received: September 21, 2024 Revised: December 02, 2024 Accepted: January 04, 2025

Figure 5: Comparing local challenges to global challenges of inclusion of BIM in curricula, Source: Author



Results & Discussions

Based on the above, the proposed vision for inclusion of BIM in the curriculum focused on submitting several proposals that are locally and globally applicable so as to give a choice area by nature, the potential of each college and architectural educational institution and its technical and technological components, the readiness of its teaching staff and the level of acceptance of its students for the new curriculum in teaching and entering the BIM world.

One of the proposals will be oriented towards the best case of study (the Architecture Faculty at Tartus University) and the most appropriate strategies used by previous experiences, where it includes an implicit proposal to reduce and mitigate as much as possible the challenges arising from our study:

Figure 6: Integrated architectural education solution (evaluation criteria and implementation stages), source: Author, based on [3].

Doi: https://doi.org/10.54216/IJBES.100203
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Integrated Architectural Education

based on the five evaluation criteria and three multi-year implementation phases as explained.

Stages of implementation:

Divide the implementation of the BIM educational integration process map into three phases, which link specific integration assessment criteria to requirements at each stage to ensure the gradual integration of BIM guaranteed and time.

Table 5: Integrated BIM Education Stages, Source: Author

Stage Name	Preparedness phase (program preparation)	Implementation phase (program deployment)	Continuous quality improvement phase (program maturity)
Proposed duration	3 years	1-3 years	Uninterrupted
Challenges to be addressed and their impact reduced	The nature of the academic environment already overloaded with materials Required financial and technical support Adherence to traditional methods of education	Weak linkages between academia and professional practices Use of BIM software is limited to 3D modeling Weak foundations for teamwork and cooperation Lack of multi-skilled professionals	Adherence to traditional methods of education Time factor between continuous labor market inputs and education outputs
Actions taken	Develop and change the level of the university and college vision, restructure the entire infrastructure and changes in the curriculum, including replacing some materials with others and abandoning some materials that are not directly related to architectural competence by focusing content and re-examining the student's educational need in proportion to labour market developments without compromising the solid academic basis of architecture. Preparation of the existing cadre with binding training courses and seminars that familiarize and educate him continuously on all aspects of BIM culture, work curriculum and impact, and use of qualified external cadres from students, Master BIM cadres and experienced practitioners in the labour market Then finally the processing phase for deployment	The method of engaging professional practice in education in the classroom and their prior involvement in the preparation of the study plan will play a crucial role in increasing interaction between intermediaries and focusing the use of students' presence in the classroom to contact practitioners and teach them the approach of making realistic BIM-style projects while students learn self-modelling tools on a platform that guides academics or courses within and outside the curriculum that require the student to each other and leaves the rest optional. Then start teaching in a multidisciplinary architectural design studio first for recent years and transdisciplinary BIM-based after graduation and propose student initiatives outside the classroom, summer camps and competitions for BIM-based group projects inside and outside the college	Continuous and progressive improvement in quality, control, replicability, and predictability within BIM capabilities Strategic planning for architectural education considers (these integration criteria) so that BIM practices are maintained and expanded in its future programs

Doi: https://doi.org/10.54216/IJBES.100203
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Table 6: Alignment of Implementation Stages and Procedures with Evaluation Criteria Source: [3].

Evaluation Standard	**BIM Integrated Education Stages**		
	1. Programme development	**2. Dissemination of programmes**	**3. Maturity of the program**
University Vision	Defining university vision for BIM concepts	Enact a university vision for BIM	BIM as a tool for teaching and learning process
Development of basic components: **Software** **Hardware** **Facilities**	Diagnosis of current educational infrastructure. Provide a plan for the development of existing educational infrastructure (software and equipment) based on specific learning goals and BEM uses defined by departments.	Installation of BIM master software and provision of licenses for teachers and students	Installing different programs in all BIM teaching spaces.
		Provision of appropriate devices for the use of BIM at the University	Provide the right devices using BIM, with plans to develop a continuous improvement program
		Create suitable spaces to teach and learn BIM.	BIM education in a collaborative learning environment with the participation of students from various disciplines.
Professional Development	Create a program to encourage BIM learning at the college. Staff training	Periodic training in accordance with the BIM implementation plan.	BIM requirements in the proficiency matrix for teacher recruitment.
Curriculum design and development	Development and establishment of new courses/modules related to management information technology	Development of existing modules for integrated BIM integration	Integrate BIM with basic architectural courses and related disciplines
Educational partnerships	Creating relationships between academics and professionals	Professional assistance in preparing BIM courses and providing practical training for teachers on BIM too	Professional offers for real case studies on BIM for students

Doi: https://doi.org/10.54216/IJBES.100203
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6. Conclusion

The previous proposal was therefore adopted as the most appropriate case for study (Tartus University's School of Architecture).

Based on readiness and preparation from the earliest stages and provides faculty with a solid basis for success in the process based on a systematic and gradual change in thought, material components and BIM teaching style culture, "In conjunction with the expansion of BIM culture locally and the increase in the number of qualified engineers to teach BIM in the labour market, students can design tools within BIM and not only as a normal modelling tool. This complements the emergence and availability of realistic examples of investment management projects at the national level. In order to fully prepare for the actual application of the curriculum and thus continue to monitor the progressive development in the quality and maturity of the application of BIM in the educational process.

Global challenges to the inclusion of BIM in the curriculum have been studied and some additional obstacles identified locally in Syria in general, where there is still a lack of mandatory procedures for the inclusion of BIM in our university curriculum and Tartus in particular where many human and technical components of BIM adoption are lacking. It was noted that the research's is compatible with many peer results.

The difference between successful and unsuccessful implementation of the BIM system has been confirmed to be linked to the mentalities and attitudes of those who use it and work habits to excel in the BIM environment, as with technologies. Given the difficulty of teaching several subjects in a limited period, most of the current curricula are designed so that they cannot offer in-depth and balanced courses on theory and practice. BIM

To address these challenges, a proposal has been made that considers it necessary to develop a completely new architectural curriculum that includes advanced digital techniques such as BIM in parallel with traditional architectural courses, selecting students and training them to keep pace with current development and engaging industrial professionals in the development and development of new curricula**.**

The findings of this study aligns with peer studies in several key areas including the following points:

• It is early not possible to consider any proposal to be ready for successful application of BIM inclusion in the curriculum and each university/educational institution should develop its own course for BIM deployment in conjunction with architecture teaching [5].

• BIM includes an implicit proposal on how and whether the sector can be reorganized and restructured in other words, this will have broad social and professional implications within the sector, making its future potential users more hesitant and perhaps an unclear reason for resistance against BIM, especially by teachers in architecture [4].

• There are some concerns about architects becoming merely a team member, rather than an "innovator, innovator" and project leader.

• BIM technology is constantly updated and developed to meet industry needs, allowing new concepts to emerge continuously. This is an additional justification for the current concern of how to integrate something that is theoretically or practically incomplete into an educational system historically based on well-established theoretical models.

• It is not only enough for students to learn the theory and function of BIM and understand its current effects, but also for them to "learn to learn" and continuously develop their practical skills and knowledge to be able to respond to changing professional practice requirements.

• Successful education development needs more than just curriculum development. There must be experienced teachers, a range of research materials, references and an environment suitable for learning.

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• It should be noted that the BIM methodology may not affect a student's competence in academic specialization; It should help to achieve them. BIM technology does not aim to change the content or purpose of the curriculum, but rather the methodology by which it is implemented.

Recommendation:

These recommendations highlight the critical need for a comprehensive and adabtable approach to BIM Education in architecture. To effectively integrate BIM into architectural education, several key considerations should be addressed:

- Faculty Development: Ongoing professional development for faculty is crucial to esure they possess the necessary ezpertise and skills to effectively teach BIM.
- Curriculum Enhancement: the curriculum should be revised to incorporate BIM principles and applications throughout the entire program, form foundational course to the advanced design studios.
- Access to Resources: adequate access to high-performance computing resources, industry standards software, and relevant data is essential for effective BIM education.
- Interdisciplinary Collaboration: Fostering interdisciplinary collaboration between architecture, engineering, and construction disciplines is critical for preparing students for real-world projects delivery.
- Industry Engagement: Strong industry partnerships are essential to provide students with real-world experiences and exposure to current BIM practices and technologies.

By addressing these challenges and critical factors, architectural education can effectively prepare students ad future professionals for the demands of

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