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Introducing BIM in Curricular Programs of Civil Engineering

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Abstraction

Building information modeling, or BIM, helps professionals in civil engineering to meet digital needs and collaborate and integrate on project development and building maintenance. The construction sector is now the primary focus of research and implementation of BIM technique, and educational institutions have been investigating the inclusion of this topic in curriculum. As aspiring professionals, civil engineering and architecture students need to keep up with the latest cutting-edge information and technologies. The main concepts and practices of the didactic strategies used to insert BIM teachings are similar across a number of academies that are better classified within the architecture and engineering sector. However, depending on the level of expertise of the school, the aspects related to architecture, structures, construction, or planning are taught in greater detail. The main subjects were discussed, along with the professional courses offered to architects and engineers, as well as the level cycles of introduction to BIM (bachelor, master, or postgraduate). Characterizing BIM education at various academies is the main goal of the curriculum study. In order to assist BIM instructors in their work, a list of activities and subjects that encourage a sufficient upgrading of the students' abilities was accomplished.

Introduction

In many different areas of the building business, the idea and practice of Building Information Modelling (BIM) are now the most relevant. The available BIM technologies enable the development of building and infrastructure projects, construction work planning, and building management activities in a centralized, digital, and cooperative manner. The creation of a geometric three-dimensional (3D) model made up of parametric items is the basis of BIM (Succar, 2009). BIM tools' ability to generate parametric models that include information about not only geometry and spatial relationships but also the properties of the materials used, geographic data, cost estimation, and warranty and certificate documents keeps BIM use at the forefront of investigating novel working practices (Youssef et al., 2013). BIM has helped the construction sector reduce mistakes, cut down on cost differences, and lessen the differences between planned and as-built construction (Milyutina, 2018). Currently, BIM implementation is widely used in several AEC (Architecture, Engineering, and Construction) business sectors worldwide. The first nation to acknowledge the nascent idea of hierarchical systems of building components was Finland. Then, in the 1970s and 1980s, the original concept was to portray the architectural elements as objects, such as a window that belongs to a given wall or a slab that is situated on a specific floor of a structure. The present phrase "Building Information Modelling" has its roots in the terms "Building Description System," "Building Product Models," and "Product Information Models" (Eastman et al., 2011). Although BIM adoption and growth began in Finland, tool development was essential to implementation, and the USA contributed significant technical advancements to the creation of BIM-based tools that could bring the BIM idea to life. Commercial software companies for the construction sector embraced the term BIM in this context, and the technological advancements used in BIM tools enable the development of more effective and superior solutions (Vilutiene et al., 2019). Globally, the BIM methodology has been primarily adopted in public buildings (Sampaio, 2018). In Europe, Finland, Norway, Sweden, and Denmark were the first to use the methodology, and they established certain policies and procedures to facilitate BIM collaborative

environments (Muller et al., 2017), [8] (Ignatov et al., 2019). Other nations, such as China and Singapore, where BIM is extensively used, created additional building-related items, and projects related to roads and railroads (Liu et al., 2017; Wang et al., 2018). In order to lower carbon emissions in the building industry, the UK government launched an initiative (Mohamed et al., 2020). Since then, most nations are researching government initiatives to encourage the use of BIM, first in public buildings and thereafter in all construction and infrastructure projects (Sampaio et al., 2016). The open BIM standard Industry Foundation Class (IFC), which supports the workflow required in an integrated design process, plays a crucial role in enabling the necessary interoperability, which is linked to the BIM competency (ISO 16739-1, 2018). The worldwide group BuildingSmart created the IFC type standards, and more comprehensive and broad versions of IFC have been created and used in more effective BIM software (Kiviniemi, 2015). In the construction industry, rapidly evolving technology has been used to enable ongoing advancements, upgrades, and refinements in a variety of work methodologies, collaboration platforms, and project delivery methods, mostly related to BIM. In their future endeavors, the civil engineering students have seized the opportunity to expand their understanding of BIM and so enhance their abilities (BIM Strategy Report, 2012). New BIM curriculum learnings may be included into engineering instruction. Additionally, civil engineering experts should acquire skills in this new field so that professionals may lead it outside of the classroom and transmit their expertise, which will boost project development effectiveness and result in optimum end products. According to Sadauskiene and Pupeikis (2018), BIM training is now required in schools due to industry needs. A curriculum analysis of the most pertinent civil engineering schools in Europe, including Portuguese academies, is presented in this research together with journal publications about BIM instruction in a few of them. A selection of European universities in the engineering, civil, and structural domains was made, and a description of the top ranking classification is given in Table 1.

Table1.UniversityrankingsforCivilEnginnering2020(Ranking,2020)

Rank	University	Country	Overall Score
8	SwissFederalInstituteofTechnologyof Lausanne	Switzerland	92.1
23	PolytechnicUniversityof Catalonia	Spain	84.6
25	PolytechnicUniversityof Turin	Italy	84.2
38	PolytechnicUniversityofMadrid	Spain	81.6
51-100	UniversityofLisbon	Portugal	-
51-100	UniversityofPorto	Portugal	-

The current study is supported by a technique based on curricular program research accessible at each of the listed universities. The goal is to determine how and at what curricular level BIM is integrated in each new or adopted unit. The curricular analyses allow for the resume of new units and units that were adapted, the curricular levels where each proposal is inserted, and the most pertinent courses (master, professional, or workshops) offered by the universities. Other didactic actions were analyzed in their context, as professional courses and workshops, as well as in master's theses. This specific selection of institutions, together with the final résumé of units (both required and elective) and courses (professional and master's, partial or full), may help new BIM educators identify appropriate teaching methodologies for BIM at their universities. A preliminary review of the literature was conducted about the methods used in a number of universalities arranged according to curriculum adaptation, BIM tool handling training, and meeting industry standards. The diverse perspectives used in the mentioned academies and described in each article are easier for readers to follow thanks to this framework. The current study's proposal delves further into studies of the course and unit topics. Depending on the academy's level of expertise or the teacher's interest, this information creates an organized curriculum that is easily adaptable to different schools. 1. AcademicStrategic: Presenting BIM This study shows that the methods developed by the chosen colleges are unique and elaborated in light of the various primary goals and research (roads, bridges, structures, and building) of each one. Although the fundamental ideas, such as parametric modeling procedures and a collaborative approach to work, are shared by all school proposals (Sampaio, 2018a), not all teachers have embraced the incorporation of BIM into civil engineering curricula because it takes time, dissemination, and recognition of the advantages of this new concept and design methodology. As a result, each academic institution has been slow to adopt BIM. education (Kevin

& Burr, 2009). Higher education's capacity to implement new training practices in response to business demands forces quick growth in both informal academia and outside-of-school educational solutions (Sacks & Pikas, 2013). Three primary viewpoints of BIM ducation were examined in a background bibliographic review: • Adaptation of the curriculum: New and innovative methods of teaching BIM have been created, integrating the BIM problem into conventional courses. Although there are significant differences in BIM education models between universities, most of them focus on integrating BIM courses within the first cycle of coursework for civil engineering degrees. Students gained knowledge of the fundamentals and practices of the interdisciplinary workflow involved in a project by creating new standard plans tailored for BIM courses. Woo (2006) outlines the novel pedagogical problems imposed by BIM as well as some of the key elements incorporated in construction training settings. Teachers are dedicated to implementing new BIM-related technologies, according to Molavi & Shapoorian (2012), who also stated specific standards for BIM education. Therefore, in a collaborative and integrated project, the use of a centralized BIM model throughout the development of multi disciplines (architecture, engineering, construction, and facilities management) is required. This requirement has been conducted to enhance distinct courses of action in undergraduate levels or even through graduate education. Concerning curriculum subjects and advanced software are used in teaching, and some experienced difficulties related to policyan and practical procedures (Luetal., 2013). The findings of an analysis of a survey conducted among students to comprehend and assess the employment of the most cutting-edge technology in civil engineering curriculum are presented by Gerber et al. (2015). According to the report, BIM is regarded by all programs as a crucial subject for the future of engineering education. According to Suwal et al. (2014), the majority of Finland's civil engineering academies have been using BIM teaching for a while, leading to a generalized understanding of applying BIM tools in actual projects, which helps the building sector. According to a study by Sadauskiene & Pupeikis (2018) on the curriculum linked to BIM in Lithuanian higher education institutions, the interdisciplinary framework that is built in schools to allow disciplines to collaborate on a semester project is the strength of BIM development. • Practical training: Based on BIM tools training, supplemental teaching materials in a BIM environment aid in reinforcing fundamental ideas like plan reading, estimating, scheduling, and construction coordination. Since the advantages of using BIM are now widely recognized in all areas of construction, the relevant theory and practice need to be taught at civil engineering and architecture schools (Joannides et al., 2012). Teachers should include the BIM approach into their lessons since it has becoming more important in the business. Some academies have established pedagogical techniques that enable students to develop new information and skills that they will utilize judiciously in the execution of their activities in the future. In particular, Wu et al. (2018) introduce students to software experience with construction planning and the identification of disciplinary conflicts in a project. Throughout the development of all activities included in the project lifecycle, BIM tools facilitate the integration of the design process, where information is moved across computer applications. For this reason, it is essential that students get training in a variety of BIM tools. Students or professionals of any level may provide BIM concept and training by learning about the capabilities and applicability of the existing software with sophisticated technologies (Dossick et al., 2014). • Industry demand: Short courses were organized in order to undertake the need of the wide range of professionals of the industry. This type of actions have become urgent to be satisfied by the academies of civil engineering. Faust [29] (2018) recognizes the relevance of BIM education to accomplish the construction sector suggestions and needs and as a first step, a unit concerning an introduction to the application of BIM, management of construction projects, was implemented in the John Brown University, Arkansas, USA. The author intents to start a link with other teachers and academies in order to observe and change didactic experiences that could me useful the BIM teachers community. Since the topics taught range from building modeling to building maintenance, the proposal put forth by Sampaio (2017) in a technical faculty covers a number of BIM concept and application facets that help students and engineers in their actual work. According to Saleeb et al. (2016), the industry and engineering colleges are increasingly collaborating to help us deliver brand-new units, modules, even full master's degrees or punctually specific workshops that are appropriately oriented to the real needs verified in these sectors. In particular, Peterson et al. (2011) mention that the upgrading in inside The most recent technical developments that may be used in the building industry must be continuously included into school courses on computers. It is advised to do so by inviting a BIM expert who has previously used the technique in their actual work and in the many construction-related domains (buildings, roads, or dams). Given this context, there are now several obstacles to the integration of BIM instruction into new or modified didactic approaches in the conventional teaching methodology. Some adjustments were made at the higher level of the courses, and with even greater expression, as full courses provided to professionals outside the school, according to the curriculum from each institution indicated in the appendices. Teachers and the academy must adhere to the need that BIM courses be included in order to enhance students' abilities and keep professionals

who need to master BIM topics up to date. 2. Program of Study: Civil Engineering All nations are rapidly implementing BIM methodology training, which is raising the necessary degree of maturity. Construction professionals' understanding of BIM has expanded beyond only being familiar with three-dimensional (3D) geometric models; they now believe that properly managing BIM data enhances the quality of their final products. The true benefits of using BIM in their particular activity must be understood by engineers, architects, and other experts involved in project development and building execution. This will allow them to enhance each partner's
Several academies consulted explicit didactic strategies for teaching the new problem, but it was confirmed that attitudes about BIM adoption varied widely. BIM topics are introduced by some at the lower level, by others at the master level, and even by specialist professionals who focus on sustainability, building, or structures. Enhancing the technical proficiency and expertise of students at every educational level or technicians who operate in their field outside of the classroom is the
Among the top-ranked colleges in the field of civil engineering, a number of academies from Switzerland, Italy, Spain, and Portugal were chosen with the intention of examining how their curriculum had been modified to include BIM. In order to assist identify pedagogical techniques and issues related to the introduction of BIM training in schools, the paper examines curriculum programs. This helps to develop future architects and engineers with the necessary skills and capabilities. According to the current studies, the master's programs at a number of colleges that provide civil engineering courses contain either optional BIM units or only BIM modules related to technical drawing or information science. Additionally, it was shown that students often supplement their education by creating final projects for MSc research and BIM modules, strengthening their abilities with BIM knowledge. In order to meet the demands of industry experts, supplementary outside BIM courses have also been made available. The report examines how top international institutions are now integrating BIM into their degree and diploma programs. Lausanne's Swiss Federal Institute of Technology
Students studying civil engineering at the Swiss Federal Institute of Technology in Lausanne are taught the fundamentals of project management, planning, building, railroad, and road construction and maintenance (Gerber et al., 2015). Along with these primary subjects, the most current study plans state that the BIM problem is not yet covered in the bachelor cycle; nevertheless, elective units on the subject are available in the master curriculum level, and a comprehensive professional course was also discovered:

• In the bachelor's cycle, the computer-aided engineering unit covers the fundamentals of computers, including programming languages, decision-supporting knowledge, and machine learning; however, BIM is not covered. • The optional unit on numerical representation and BIM in the master cycle covers topics like creating BIM structural models with parametric objects found in libraries and encourages a number of BIM-related activities, such as digital databases, teamwork, and structural project management. • In the master cycle, the overview of an elective unit on BIM begins with the fundamentals of parametric modeling, or BIM, and then delves further into the methodology's application via a more in-depth examination of the architectural project's changing practice globally. Level of detail or development (LOD), IFC standards and interoperability capabilities, BIM in project teams of architects and civil engineers, BIM-based software training (ArchiCAD, Revit, Revizto, and OpenBIM concept), and construction are some of the subjects covered. construction estimate costs (5D) and schedules (4D). The BIM unit is focused on showcasing BIM as an integrated and cooperative platform. • As part of their master's thesis, students use their prior BIM skills to construct research projects related to actual buildings or infrastructure problems. BIM subjects are only covered at the conclusion of the academic program at the Swiss Federal Institute of Technology in Lausanne, not in the year cycles. Catalan Polytechnic University
The degree in civil engineering at the Polytechnic University of Catalonia's Civil Engineering Academy in Barcelona includes pertinent educational formative contents of a variety of engineering sectors, such as construction, infrastructure, structural analyses, hydraulic topics, and a strong foundation in elementary sciences. Although the master's level includes a broad variety of studies pertaining to the many activities of a civil engineer, BIM is not mentioned in any of the units contained in the present bachelor's and master's cycle curriculum. Complete specialized BIM courses are only available to professional master's degree holders (Picó, 2009). • In the bachelor's program, BIM is not taught in courses like representation systems and metric geometry, which cover topics related to BIM computer issues. Only the ability to comprehend spatial vision and the proficiency in defining technical designs using CAD systems are included in the summary.

• Technical Drawing Design and Numerical Calculation Unit: This optional unit in the master cycle seeks to introduce the fundamentals of computer usage and programming. It also covers graphical file data structures, file exporting methods, an introduction to 3D geometry, and how to use a CAD application to create drawings and 3D models without mentioning BIM. • A new professional course on BIM modeling for building construction is available in professional master's. Understanding how teams and integrated works are organized, managed, and coordinated when supported by BIM collaborative platforms is one of the course's topics.

A practical training component pertaining to the creation of BIM models across many disciplines is also taken into consideration. The control of facility management services activities created in BIM settings is described in the professional master's program, which is another specialized professional degree. There were distinct subjects that were mostly focused on data gathering, research, and transfer as well as BIM software handling. Using BIM-based software, the professional master's course in structures seeks to provide engineers with methodological knowledge, suitable data transfer procedures, and the ability to produce the written and visual documentation needed for the structural project. Although it offers a number of professional master's programs focused on different specialties, the Polytechnic University of Catalonia in Barcelona has incorporated BIM themes in its annual cycles. Turin Polytechnic University A curriculum designed to educate building and infrastructure design, construction, management, and maintenance is offered by the Polytechnic University of Turin's Faculty of Civil Engineering (Donato, 2017). The first university to offer BIM as a bachelor's degree is this faculty. This was prompted by the government's introduction of a requirement for the use of BIM at the public building project level. As a result, the school had to modify and incorporate its idea into the first year of instruction. A number of professional courses were also developed. • The technical sketching unit in the bachelor's cycle focuses only on the drawing as a fundamental communication tool and the creation of drawings and geometric models using CAD software. Additionally, there were remarks on BIM techniques related to the construction sector. • In master cycle: The new BIM unit, developed inside a particular master focused on built structures, has the goal of equipping students with the necessary BIM skills to produce building projects and assist with maintenance activities. A first reference to the concept of BIM was discovered at the Polytechnic University of Turin. The institution offers a comprehensive BIM master's degree that is focused on building structures. Madrid's Polytechnic University The Polytechnic University of Madrid's Faculty of Civil Engineering offers a variety of fascinating subjects. for engineers' work that includes both practical and pertinent theoretical elements. Although BIM is not taught at the bachelor's level, a new master BIM unit focused on building management was developed (Lozano-Díezet al., 2018): • The graphic expression unit in the bachelor cycle, in summary, teaches graphical expression methods and spatial vision skills based on computer-aided design software and descriptive geometry, however BIM is not taught.

• In mastercycle: The unit on constructed constructions in a management context outlines the ability to link and exchange project lifecycle management of multinational work using BIM technologies. Concept, applications, available BIM software, creating and managing BIM models, and the data flows needed for a collaborative BIM project are all covered in the topic. No BIM subject is taught at the Polytechnic University of Madrid. The school offers a master course that teaches the fundamentals and how to use BIM software. Lisbon University The formal curriculum at the University of Lisbon's Department of Civil Engineering enables students to meet the demands of the construction industry and prepare them for their future professional activities. During the first year of the degree, students learn the fundamentals of BIM methodology and how to use a BIM modeling program (Sampaio, 2015). Professionals in the industry are currently able to take short courses about BIM concepts and their applicability (Sampaio & Martins, 2021). In the last ten years, a number of MSc theses covering a variety of subjects have also been created (Sampaio, 2018b), and a new BIM unit will be available starting in 2021 (Sampaio, 2019). • The computer-aided drawing (CAD) unit in the bachelor's degree covers the use of CAD tools to create technical drawings used in civil engineering. It also provides a basic overview of BIM methodology with a hands-on component on creating the architectural and structural elements of a BIM model.

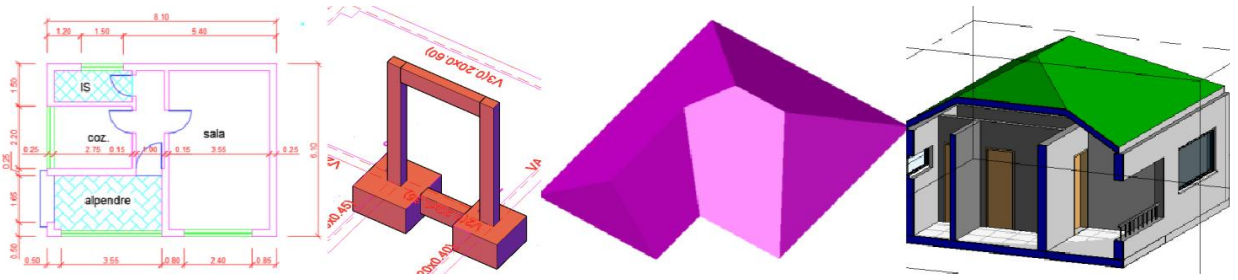

Figure1.DrawingsandmodelscreatedbystudentsinCADunit

• The suggested unit on BIM methodology in the master cycle provides an overview of the parametric modeling idea, handles a BIM tool as a practical feature, and introduces collaborative projects. The course material includes modeling exercises related to budgeting, sketching, plumping, and construction. • Short courses: The institution provides brief courses on the need for BIM among experts in the construction sector. These courses cover several areas of civil engineering, namely construction planning, structural analysis, geotechnics, works management, and building maintenance (Figure 2).

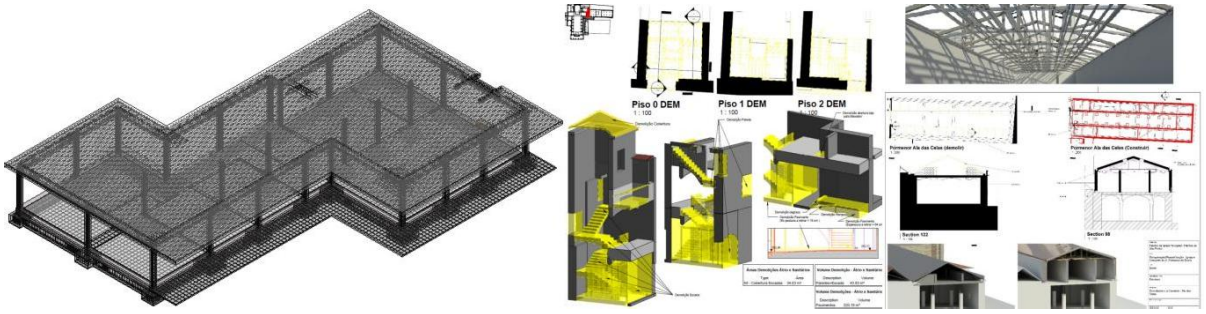

Figure2.Imagesofshortcoursespresentations

• In students' workshop: Finalist students requested the school's BIM workshop. The one-day BIM course encourages students to learn more about BIM, which is helpful for their training and, eventually, for their job as engineers, as they become more competent and ready to succeed in their roles. The course's material focuses on a practical aspect and a broad sample of how (Figure 3) might be used.

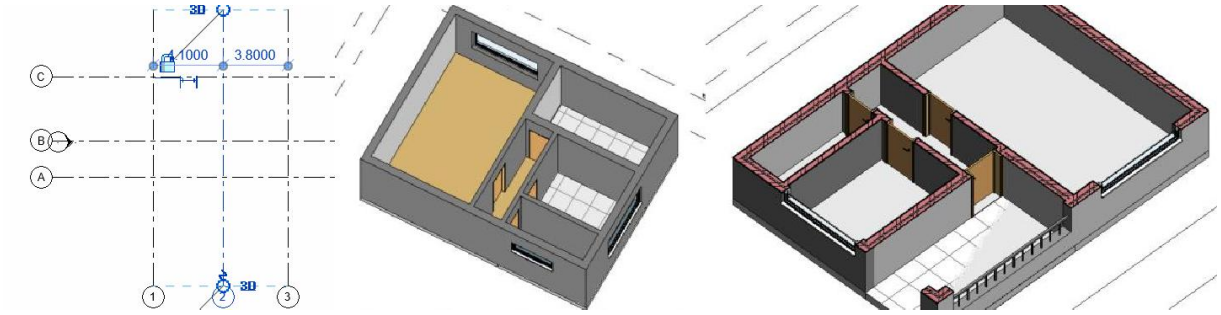

Figure3.ImagespresentedinworkshopconcerningtheuseofaBIMsoftware

• In master's theses, the creation and management of BIM models created in a didactic setting serves as the foundation for the introduction of BIM methodology. Applications of the studies span a number of cross-cutting fields, including transportation infrastructure, structural design, geotechnics projects, interoperability analyses in structural design, comparisons between traditional and BIM project measurements of quantities, and the creation and certification of BIM parametric objects of floors, walls, and roofs (Figure 4).

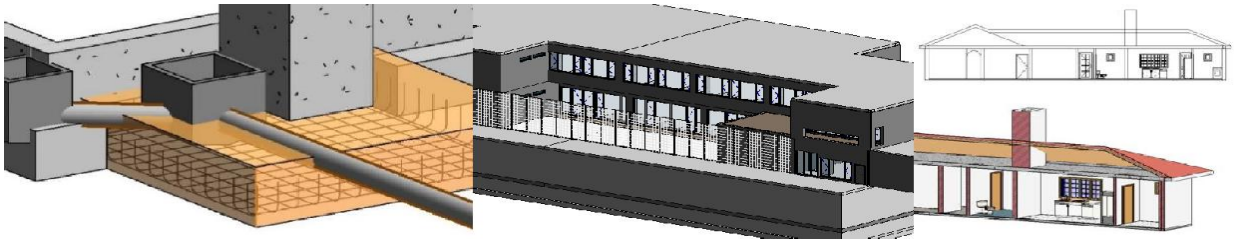

Figure4. ImagensfromMSc theses

A few years ago, first-year students at the University of Madrid were given the BIM subject in the Technical Drawing unit. A full unit is suggested, with 2021–2022 as the first year of application. Nonetheless, during the last ten years, master's theses and seminars on BIM have been established with significant involvement from experts and students. The figures' photos show the outcomes of the master's thesis and the classes, as well as a few of the short courses' presentation slides. Porto University The University of Porto offers a wide selection of subjects related to the degree in civil engineering, emphasizing a pertinent relationship between academia and industry. Although it was discovered that BIM is not covered in the bachelor cycle, two BIM problems were included in the last semester of the course: • No BIM is taught at the first educational level in the bachelor's cycle. In order to engage with project partners and provide digital project papers, the technical drawing unit seeks to convey the drawing as a technical language based on regulations. Classes only utilize CAD software. • In the master cycle, BIM in buildings is referred to as an advanced technology by the optional computing in the construction unit. Understanding the use of BIM in project, construction planning, budgeting, maintenance, and rehabilitation is the major focus of the course. In order to maintain models, organize projects, and communicate with all stakeholders, it also entails using a BIM modeling tool and multipurpose platforms. • Master Cycle: In this master course on building information systems, the digital data management concept is introduced, the necessary workflows for the development of various construction processes are identified, and the requirements of construction companies, offices, and enterprises in the development of construction products are analyzed. Lastly, students at the University of Porto are now given a unit and a master course, but no BIM instruction is provided to first-year students. Discussion of the Curriculum Education on BIM technique was based on the demands of the construction sector. Teaching BIM involves a wide variety of subjects, namely data flows, tools, and ideas. It is possible to identify certain strategic lines of organizations, aims, and contents by consulting a number of curricular programs of particular units and courses relevant to this topic. The needs of the construction sector are met by its BIM educational proposals. The main goal of introducing BIM courses in the classroom is to provide professionals and students a suitable grasp of the technique and its relevance. Teachers who teach drawing or informatics-related subjects are thus the first actors and are therefore more likely to embrace BIM training, idea, and practice in their teaching activities. The structure of the current text supports the key points and highlights BIM materials that demonstrate the instructional approach each school uses: • All academic institutions employ CAD systems in the bachelor's program, but only at ULisbon and PUTurin provide courses that provide a basic introduction to BIM. Actually, only a nascent understanding of 3D modeling based on parametric objects can be taught at this level. Nonetheless, a number of departments across all institutions provide the use of CAD systems for 2D and 3D designs. • In the master cycle, only a proposal for a BIM unit to be added to ULisbon was developed; BIM has not yet been implemented in ULisbon or UPCatalonia. • In the master cycle, the Universities of Laussanne, Madrid, Turin, and Porto included BIM as a new course that might be required or elective. • In masters programs that are professional or specialized, the Polytechnic University of Catalonia included the BIM course as a whole to the Control of Facility Management Services master.

• In workshops or short courses: The University of Lisbon hosted a number of one-day BIM courses for industry experts and engineering finalist students. • Master theses: Over the last ten to fifteen years, several master theses with a broad variety of themes have been established in all schools. It is feasible to identify pertinent topics about BIM contents and goals from the curriculum study: • Fundamental ideas: discovered to be included in both the introductory BIM topics and a practical component, these ideas are shared by all instructional approaches. The concept of BIM methodology, applications, and software modification are discussed first, then information centralization, process integration, and the idea of collaborative projects based on the structure of BIM teams of civil engineers and architects. Additional fundamental subjects include data implementation and workflow, IFC standard, interoperability capability, and follow-up work and monitoring. Additionally, the methodology's spectrum of application is outlined, along with its limitations and advantages. • Practice: Students and participants in professional courses are encouraged to handle a variety of BIM-based tools, which improves their computer abilities. Using modeling BIM software (Revit, ArchiCAD, Allplan, or AECOsim), the architectural, structural, and MEP components of a BIM model were created. Navisworks was used to create the discipline-to-discipline conflict assessments. Based on bi-directional workflow data, the software's compatibility was verified across ArchiCAD/Revit, Revit/Robot, and Revit/Revizto transfers. The accessible BIM collaboration platform is mentioned in order to effectively integrate all tasks needed for a building lifecycle and handle all disciplines of a whole project.• Particular topics: Structures: The interoperability constraint is the main topic of instruction in a structural project. Robot, ETABS, SAP, Cype, and

Tricalc are used to construct structural projects, and buildings, bridges, tunnels, metro stations, schools, and hospitals are all included in the case studies. o building: Planning, measuring, and budgeting are crucial subjects that are taught throughout the building process. It calls for the creation of both 4D models (construction schedules) and 5D models (material quantities and cost estimates). Virtual and augmented reality technology may be used to these activities.
o Maintenance and facilities management: An integrated and collaborative BIM platform can assist the maintenance and management duties necessary in a facility. A comprehensive BIM model facilitates building facilities management, including maintenance (7D) and other analyses targeted at optimizing building performance, such as energy simulations (6D) or sustainability.
Though some higher education lecturers have a conservative mindset, there has been a rapid adoption of BIM topics, particularly in the final level of the Civil Engineering degree curriculum and in some master's and professional courses that are closely partnered with the industry. In addition to supporting other ideas that instructors wanted to apply in their academy, the top list of contents, which is arranged by cycle levels and courses, clearly identifies the tactics each institution has followed. Concerning the requirement of introducing the handling of BIM-based tools in the annual level of Civil Engineer courses, are noteworthy changes that have to be made in all institutions. The younger pupils pick up new software and its features with ease. Nonetheless, students should be informed of the true advantages of BIM at the final cycle level. Teachers at the academies must plan courses or workshops with subjects and expertise oriented to the required demand from distinct sectors, such as structures, construction, project management, or building maintenance activity, for the professionals who demand a specific direction of BIM application. Pay attention to the main conversation. Younger students like the first exposure to BIM, but students who are about to leave the academy are better able to comprehend the true potential of the BIM approach. The final students are more familiar with the particular areas, such as infrastructure, management, or construction, and they can think more deeply about BIM and its many applications.

3. Findings The academy's efforts to stay current with the latest advancements in computers used in the construction industry are discussed in the book. This request is made by industry experts as well as the academies, who have established practical methods for teaching students about BIM. An overview of curriculum adaptation was first found to be divided into three primary academies: curriculum adaptation, tool handling training, and meeting industrial demands.
With the primary goal of determining how universities and polytechnics help implement BIM in their organizations, a more thorough investigation was conducted by university, unit, and content to find a significant gap in the practical component's introduction during the first cycle and following the provision of professional courses with specialized knowledge. It examined a number of courses and determined the primary problems: The first topic focuses on concept and applicability; it is followed by a hands-on experience creating BIM models using the available BIM-based tool and using BIM data to accomplish multi-tasks developed over the model; it is followed by an analysis of the syllabus and the types of units and courses offered to professionals and students, from which several observations can be made related to university preferences for more comprehensive courses or management, construction, or infrastructure perspectives; and lastly, it is also attended, the collaborative characteristic of BIM in the definition of large teams involving multiple disciplines, in the development of collaborative works supported in BIM platforms.

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