

## PAPER

# Scenarios of Building Information Modelling-Based Design Education in Architecture Schools

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## ABSTRACT

Due to the rapid development of computer technologies and trends in digital design, including building information modeling (BIM) and its diffusion into architectural design practice, it was necessary to introduce BIM into architectural curricula in order to prepare students for practice. This article therefore aims to identify scenarios for teaching BIM to architecture students worldwide. To achieve this objective, a thematic analysis of BIM teaching experiences in several selected academic institutions was conducted. The data studied included published articles and official university websites dealing with BIM teaching. A theoretical framework for BIM education was determined, comprising two aspects: pedagogical methods for BIM education and specifications for BIM courses in architecture programs. The document identified several scenarios for teaching BIM in multidisciplinary or architecture-specific courses. BIM teaching can be offered as part of a single course integrated with other courses, or as a separate course. It may be taught as part of related or unrelated courses. Related courses can be organized in parallel with an academic semester, or over several semesters. In addition, there are different types of input to project-based BIM teaching, such as a new design project, the results of a previous design course or an actual project. These scenarios can serve as a reference for universities wishing to integrate BIM into their programs.

## KEYWORDS

architecture schools, building information modeling (BIM), BIM teaching scenarios, course integration, higher education

## 1 INTRODUCTION

Architectural design is one of the disciplines that has been positively influenced by computer technologies, laying the foundations for what is known as computer-aided architectural design (CAAD) [1]. Digital tools are no longer just representation tools, but have become essential elements of the design process [2], such as the use of CAD models with simulation programs for building energy performance [3]. The architectural design process has gradually become digital, particularly with the adoption of

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# Journal Of Building Information Modeling

**Weisheng Lu, Chimay J. Anumba**



## **Journal Of Building Information Modeling:**

**Building Information Modeling** Dana K. Smith, Michael Tardif, 2012-04-23 The optimal approach to design build operate and maintain buildings With this strategic guide to building information modeling BIM you will learn how to implement this new technology as part of a comprehensive systems approach to the design construction management operation maintenance and use of buildings The authors among the leading experts and pioneers in BIM show you how BIM supports more streamlined integrated and efficient business processes throughout the lifecycle of buildings from their initial conception through their eventual retirement or reuse The result is better quality buildings lower construction and operating costs shorter project turnaround times and a higher quality of building information to support better business decisions Moreover they set forth a plan for incorporating BIM into every organization's existing workflows enabling you to take full advantage of all the benefits that BIM offers Everything you need to implement a BIM approach is set forth in detail including The business case for BIM demonstrating how it can improve collaboration facilitate better design and construction optimize workflow and help reduce risk Guidance for meeting the challenges of BIM such as an entrenched business culture the proliferation of BIM tools and the uneven rates of BIM adoption The big picture view showing how your organization can work with business partners and fit into the building life cycle in a BIM enabled industry Throughout the book sample documents and figures help you better understand the principles of BIM and how it works in practice In addition first hand accounts show you exactly how adopters of BIM have gained a competitive edge Architects engineers constructors building owners and facility managers can turn to this book to realize the full potential of BIM and radically improve the way buildings are designed built operated and maintained

*Handbook of Research on Building Information Modeling and Construction Informatics: Concepts and Technologies* Underwood, Jason, Isikdag, Umit, 2009-12-31 In recent years building information modeling has become a very active research area of construction informatics with investigation of ICT use within construction industry processes and organizations The Handbook of Research on Building Information Modeling and Construction Informatics Concepts and Technologies addresses the problems related to information integration and interoperability throughout the lifecycle of a building from feasibility and conceptual design through to demolition and recycling stages Containing research from leading international experts this Handbook of Research provides comprehensive coverage and definitions of the most important issues concepts trends and technologies within the field

Research Companion to Building Information Modeling Weisheng Lu, Chimay J. Anumba, 2022-03-31 Offering critical insights to the state of the art in Building Information Modeling BIM research and development this book outlines the prospects and challenges for the field in this era of digital revolution Analysing the contributions of BIM across the construction industry it provides a comprehensive survey of global BIM practices Accessible and thorough the chapters explore the theory behind and facilitators of BIM covering knowledge management around BIM the development of ontologies and language in the area

holistic implementations and BIM ecosystems The book further discusses the technological developments of BIM including scan to BIM 3D digital reconstruction and AI and robotics techniques Critical analysis of BIM enabled construction and engineering management innovations are also examined highlighting prospects and challenges in the area This will be a critical read for engineering construction management and architecture students looking for a comprehensive study of BIM It will also be beneficial to practitioners working in the Architecture Engineering Construction Owner Operation AECOO industry wanting a better understanding of the benefits and future developments of BIM

*Building Information Modeling* Karen Kensek, Douglas Noble, 2014-06-09 The bright future and exciting possibilities of BIM Many architects and engineers regard BIM as a disruptive force changing the way building professionals design build and ultimately manage a built structure With its emphasis on continuing advances in BIM research teaching and practice Building Information Modeling BIM in Current and Future Practice encourages readers to transform disruption to opportunity and challenges them to reconsider their preconceptions about BIM Thought leaders from universities and professional practice composed essays exploring BIM's potential to improve the products and processes of architectural design including the structure and content of the tools themselves These authors provide insights for assessing the current practice and research directions of BIM and speculate about its future The twenty six chapters are thematically grouped in six sections that present complementary and sometimes incompatible positions Design Thinking and BIM BIM Analytics Comprehensive BIM Reasoning with BIM Professional BIM BIM Speculations Together these authors provide stimulating ideas regarding new directions in building information modeling

Building Information Modeling in Pedagogy and Practice Anne K. Anderson, Kevin R. Miller, David E. Gunderson, 2025-08-11 The adoption of building information modeling BIM in both pedagogy and practice has experienced significant growth in the past decade As the use of BIM is being quantitatively and qualitatively shown to improve project outcomes many educators and practitioners are still struggling with how to incorporate BIM into curriculum training and current and future projects This book is a compilation of the best academic and research articles on the topic of BIM provides a resource for both educators and practitioners for understanding issues regarding BIM covers BIM topics such as BIM Execution Planning Collaboration Visualization Site Utilization Planning Safety Estimating Sequencing Coordination Clash Detections Integrated Project Delivery Legal considerations for BIM Industry Uses of BIM Sustainability Facilities Management Interoperability Modular Construction and Virtual Reality and includes a new introduction and conclusion Building Information Modeling in Pedagogy and Practice will be an invaluable resource for engaged academics and teaching practitioners interested in playing a key role in the future development of the building profession as well as undergraduate and postgraduate students wishing to understand the importance of BIM Most of the chapters in this book were originally published in the International Journal of Construction Education and Research

*Research Companion to Building Information Modeling* Lu, Weisheng, Anumba, Chimay J., 2022-03-22 Offering critical insights to the state of the art in

Building Information Modeling BIM research and development this book outlines the prospects and challenges for the field in this era of digital revolution Analysing the contributions of BIM across the construction industry it provides a comprehensive survey of global BIM practices

**Building Information Modeling** Régine Teulier, Marie Bagieu, 2023-12-22 This book presents how Building Information Modeling BIM and the use of shared representation of built assets facilitate design construction and operation processes ISO 19650 The modeling of public works data disrupts the art of construction Written by both academics and engineers who are heavily involved in the French research project Modélisation des Informations Interopérables pour les Infrastructures Durables MINnD as well as in international standardization projects this book presents the challenges of BIM from theoretical and practical perspectives It provides knowledge for evolving in an ecosystem of federated models and common data environments which are the basis of the platforms and data spaces BIM makes it possible to handle interoperability very concretely using open standards which lead to openBIM The use of a platform allows for the merging of business software and for approaches such as a Geographic Information System GIS to be added to the processes In organizations BIM meets the life cycles of structures and circular economy It is not only a technique that reshapes cooperation and trades around a digital twin but can also disrupt organizations and business models

**Building Information Modelling (BIM) in Design, Construction and Operations** L. Mahdjoubi, C.A. Brebbia, R.

Laing, 2015-09-09 Building Information Modelling BIM in Design Construction and Operations contains the proceedings of the first in a planned series of conferences dealing with design coordination construction maintenance operation and decommissioning The book gives details of how BIM tools and techniques have fundamentally altered the manner in which modern construction teams operate the processes through which designs are evolved and the relationships between conceptual detail construction and life cycle stages The papers contributed by experts from industry practice and academia debate key topics develop innovative solutions and predict future trends The interdisciplinary nature of the contents and the collaborative practices discussed so important within the built environment will appeal to those engaged in design surveying visualisation infrastructure real estate construction law insurance and facilities management Topics covered include BIM in design coordination BIM in construction operations BIM in building operation and maintenance BIM and sustainability BIM and collaborative working and practices BIM health and safety and BIM facilities management integration among others

**Building Information Modelling (BIM) in Design, Construction and Operations II** A. Galiano-Garrigos, L.

Mahdjoubi, C.A. Brebbia, 2017-08-09 The papers presented at Building Information Modelling 2017 BIM are from a range of forums including plenary papers workshops seminars and panel sessions The conference was attended by experts from industry practice and academia sharing their work on key topics the development of innovative solutions and the identification future trends The volume gives details of how BIM tools and techniques have fundamentally altered the manner in which modern construction teams operate the processes through which designs are evolved and the relationships between

conceptual detail construction and life cycle stages BIM is essentially value creating collaboration throughout the entire life cycle of an asset underpinned by the statistics attached to them and has far and reaching consequences on both building procurement and infrastructure BIM 2017 papers cover topics such as BIM in design coordination Construction operations Building operation and maintenance BIM and sustainability Collaborative working and practices Facilities management integration and GIS integration Automation in construction Health and safety BIM and interoperability Life cycle project management Cultural heritage BIM and Robotics Risk analysis and management and Emergency analysis planning and management Building Information Modelling (BIM) in Design, Construction and Operations III P. De Wilde,L.

Mahdjoubi,A Galiano Garrigós,2019-12-10 Originating from the 2019 International Conference on Building Information Modelling this book presents latest findings in the field This volume presents research from a panel of experts from industry practice and academia touching on key topics the development of innovative solutions and the identification future trends

Building Information Modeling André Borrmann,Markus König,Christian Koch,Jakob Beetz,2018-09-19 Building Information Modeling BIM refers to the consistent and continuous use of digital information throughout the entire lifecycle of a built facility including its design construction and operation In order to exploit BIM methods to their full potential a fundamental grasp of their key principles and applications is essential Accordingly this book combines discussions of theoretical foundations with reports from the industry on currently applied best practices The book s content is divided into six parts Part I discusses the technological basics of BIM and addresses computational methods for the geometric and semantic modeling of buildings as well as methods for process modeling Next Part II covers the important aspect of the interoperability of BIM software products and describes in detail the standardized data format Industry Foundation Classes It presents the different classification systems discusses the data format CityGML for describing 3D city models and COBie for handing over data to clients and also provides an overview of BIM programming tools and interfaces Part III is dedicated to the philosophy organization and technical implementation of BIM based collaboration and discusses the impact on legal issues including construction contracts In turn Part IV covers a wide range of BIM use cases in the different lifecycle phases of a built facility including the use of BIM for design coordination structural analysis energy analysis code compliance checking quantity take off prefabrication progress monitoring and operation In Part V a number of design and construction companies report on the current state of BIM adoption in connection with actual BIM projects and discuss the approach pursued for the shift toward BIM including the hurdles taken Lastly Part VI summarizes the book s content and provides an outlook on future developments The book was written both for professionals using or programming such tools and for students in Architecture and Construction Engineering programs Building Information Systems in the Construction Industry A. Galiano Garrigos,C.A. Brebbia,L. Mahdjoubi,R. Laing,2018-01-24 The selected papers in this book deal with Building Information Modelling BIM in Design Construction and Operations Application of BIM throughout the construction

industry is progressing at an accelerated rate with the development of new software tools BIM has the potential to alter the way in which different specialities interact before during and after the construction project BIM carries the data set for a particular asset through its full life cycle which has important consequences for operations and maintenance as well as for infrastructure planning BIM emergence has been the result of advanced surveying techniques powerful computer systems better visualisation tools and new communication infrastructures The papers included in this book demonstrate the interdisciplinary character of BIM bringing together contributions from experts in industry practice and academia

Building Information Modeling For Dummies Stefan Mordue,Paul Swaddle,David Philp,2015-12-21 Everything you need to make the most of building information modeling If you re looking to get involved in the world of BIM but don t quite know where to start Building Information Modeling For Dummies is your one stop guide to collaborative building using one coherent system of computer models rather than as separate sets of drawings Inside you ll find an easy to follow introduction to BIM and hands on guidance for understanding drivers for change the benefits of BIM requirements you need to get started and where BIM is headed The future of BIM is bright it provides the industry with an increased understanding of predictability improved efficiency integration and coordination less waste and better value and quality Additionally the use of BIM goes beyond the planning and design phase of the project extending throughout the building life cycle and supporting processes including cost management construction management project management and facility operation Now heavily adopted in the U S Hong Kong India Singapore France Canada and countless other countries BIM is set to become a mandatory practice in building work in the UK and this friendly guide gives you everything you need to make sense of it fast Demonstrates how BIM saves time and waste on site Shows you how the information generated from BIM leads to fewer errors on site Explains how BIM is based on data sets that describe objects virtually mimicking the way they ll be handled physically in the real world Helps you grasp how the integration of BIM allows every stage of the life cycle to work together without data or process conflict Written by a team of well known experts this friendly hands on guide gets you up and running with BIM fast

**Building Information Modeling** Raymond Issa,Svetlana Olbina,2015-06 **BIM for Design Coordination** Fernanda L. Leite,2019-11-26 A tactical guide to successful Virtual Design and Construction project coordination featuring case studies from leading VDC firms Virtual Design Coordination VDC employs information rich Building Information Modeling BIM to enable specialty designers and contractors to create a single coordinated set of designs that can prevent cost overruns avoid schedule delays and identify issues in the field Although BIM based design coordination is widely used in the commercial construction industry there remains a need for a standardized practice BIM for Design Coordination formalizes industry best practices and provides structured guidelines to the process Helping readers gain the benefits of BIM based design coordination this practical guide covers areas such as setting up a project for success model quality impacts on design coordination carrying out a successful VDC session and more Specific guidelines for various

project stakeholders are laid out in detail while real world examples of project design coordination workflows and templates for BIM Project Execution Plans PxPs are provided throughout the text Written by a leading expert and educator in the field this book Provides a formal set of BIM based design coordination guidelines that emphasize construction stage coordination Features real life case studies that illustrate how leading firms approach design coordination Covers BIM based design coordination in other industries such as infrastructure and industrial sectors Presents guidelines for all project stakeholders including subcontractors architects engineers fabricators and owners Includes chapters on teaching BIM based design coordination and the future of the field BIM for Design Coordination A Virtual Design and Construction Guide for Designers General Contractors and MEP Subcontractors is a much needed resource for general contractors and members of VDC teams as well as academics students and professionals new to BIM based design coordination

**Industry 4.0 Solutions for Building Design and Construction** Farzad Pour Rahimian, Jack Steven Goulding, Sepehr Abrishami, Saleh Seyedzadeh, Faris Elghaish, 2021-12-20 This book provides in depth results and case studies in innovation from actual work undertaken in collaboration with industry partners in Architecture Engineering and Construction AEC Scientific advances and innovative technologies in the sector are key to shaping the changes emerging as a result of Industry 4 0 Mainstream Building Information Management BIM is seen as a vehicle for addressing issues such as industry fragmentation value driven solutions decision making client engagement and design process flow however advanced simulation computer vision Internet of Things IoT blockchain machine learning deep learning and linked data all provide immense opportunities for dealing with these challenges and can provide evidenced based innovative solutions not seen before These technologies are perceived as the true enablers of future practice but only recently has the AEC sector recognised terms such as golden key and golden thread as part of BIM processes and workflows This book builds on the success of a number of initiatives and projects by the authors which include seminal findings from the literature research and development and practice based solutions produced for industry It presents these findings through real projects and case studies developed by the authors and reports on how these technologies made a real world impact The chapters and cases in the book are developed around these overarching themes BIM and AEC Design and Optimisation Application of Artificial Intelligence in Design BIM and XR as Advanced Visualisation and Simulation Tools Design Informatics and Advancements in BIM Authoring Green Building Assessment Emerging Design Support Tools Computer Vision and Image Processing for Expediting Project Management and Operations Blockchain Big Data and IoT for Facilitated Project Management BIM Strategies and Leveraged Solutions This book is a timely and relevant synthesis of a number of cogent subjects underpinning the paradigm shift needed for the AEC industry and is essential reading for all involved in the sector It is particularly suited for use in Masters level programs in Architecture Engineering and Construction

*Building Information Modeling for a Smart and Sustainable Urban Space* Rafika Hajji, Hassane Jarar Oulidi, 2022-01-26 Urban spaces are being called upon to develop a capacity for resilience and



sustainability in order to meet the major challenges they face To achieve such a goal a practical development framework must be implemented in order to take advantage of the technological innovations that characterize the field of construction and urban engineering Today multi scale BIM is bringing about significant changes that are redefining the paradigms of urban management It facilitates simulations of the sustainability of urban spaces with respect to several criteria most notably relating to energy the economy and the environment Building Information Modeling for a Smart and Sustainable Urban Space proposes a theoretical and practical framework for implementing BIM models for the creation of sustainable and intelligent urban spaces It addresses the issues of acquisition modeling interoperability and BIM and GIS integration for the production of BIM models Case studies are presented providing a practical dimension that demonstrates the production process of the urban model and its contribution to multiscale simulations particularly in real estate evaluation and urban renewal

**Building Information Modeling for Renovation and Refurbishment** Timo Hartmann, Sharon Susan Verghese, Jan-Derrick Braun, Jessica Steinjan, 2026-02-02 Building Information Modeling or BIM has been widely applied to new construction projects but is less used to support renovation activities Building Information Modeling for Renovation and Refurbishment A Practical Guide addresses that issue and provides a practical guide centered around well defined use cases of applying BIM to demonstration projects The authors have worked on the European Union s Horizon 2020 funded BIM Speed project where they developed more than 20 such use cases with demonstrative implementations on real world renovation projects The use cases were also formalized as standard BuildingSmart International use cases The book provides a more accessible and general description of a selected number of the most important of these use cases for renovation practitioners Additionally the book will discuss requirements for information management and BIM implementation planning for renovation projects to allow for the seamless implementation of use cases on projects

**Building Information Modeling** Karen Kensek, 2014-04-16 This is a design guide for architects engineers and contractors concerning the principles and specific applications of building information modeling BIM BIM has the potential to revolutionize the building industry and yet not all architects and construction professionals fully understand what the benefits of BIM are or even the fundamental concepts behind it As part of the PocketArchitecture Series it includes two parts fundamentals and applications which provide a comprehensive overview of all the necessary and essential issues It also includes case studies from a range of project sizes that illustrate the key concepts clearly and use a wide range of visual aids Building Information Modeling addresses the key role that BIM is playing in shaping the software tools and office processes in the architecture engineering and construction professions Primarily aimed at professionals it is also useful for faculty who wish to incorporate this information into their courses on digital design BIM and professional practice As a compact summary of key ideas it is ideal for anyone implementing BIM

**Research Anthology on BIM and Digital Twins in Smart Cities** Management Association, Information Resources, 2022-09-16 In recent years smart cities have been an emerging area of

interest across the world Due to this numerous technologies and tools such as building information modeling BIM and digital twins have been developed to help achieve smart cities To ensure research is continuously up to date and new technologies are considered within the field further study is required The Research Anthology on BIM and Digital Twins in Smart Cities considers the uses challenges and opportunities of BIM and digital twins within smart cities Covering key topics such as data design urban areas technology and sustainability this major reference work is ideal for industry professionals government officials computer scientists policymakers researchers scholars practitioners instructors and students

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