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IZVLEČEK

Glede na poglobljeni in primerjalni pregled člankov, objavljenih za uporabljene vrste programske opreme za ”Informacijsko modeliranje zgradb” (BIM), študija omogoča širši razumevanje in kritičen razmislek o vključevanju in sintezi razvoja BIM v izobraževalni sistem na Kosovu z namenom podajanja smernic akademskim raziskovalcem, študentom in strokovnim delavcem. Ker je učinkovitost BIM široko sprejeta v svetovni industriji ”Arhitekture, Inženiringa, Konstruiranja” (AEC), je potrebno vzpostaviti sinergijo med izobraženimi BIM kadri in tistimi, ki se v praksi ukvarjajo z aplikacijo BIM programske opreme na Kosovu. To vodi k iskanju intenzivnejših in primernejših pristopov ter orodij z namenom vzpostavljanja integralnih rešitev preko izobraževalnega sistema; zlasti z namenom, da bi ponudili znanje svetovne praktike BIM v izobraževalne programe, ki so usmerjeni v trajnostni razvoj ter AEC, učne načrte in/ali tečaje.

Večina Tehničnih fakultet Univerz na Kosovu pretermit viabilnost BIM-a kot strategija poučevanja in načrtuje premagovanje ovir za integracijo BIM-a v kurikulum. Z izvedenim vprašalnikom iz roktva smo raziskali trenutno stanje integracije BIM na programih visokošolskega izobraževanja ”Sustainable Architecture and Construction” (SAC). Na podlagi pridobljenih odgovorov smo ugotovili, da je pripomoljivo povečanje znanja ocenjevalca za evalvacijo vključitev BIM v učne načrte ter novi trajnostni didaktični koncepti in zavedanje, kar bi omogočilo diplomantom pridobitev znanj o BIM programski opremi pred vključitvijo v profesionalno kariero.

KLJUČNE BESEDO

”Informacijsko modeliranje zgradb” (BIM), izobraževalni proces, učni načrt, vprašalnik.

ABSTRACT

After a comparative review of articles published for used types of “Building Information Modeling” (BIM) software, this study provides a wider understanding and critical reflection on integration and synthesis of BIM developments into Kosovo education system in order to provide important guidance to academic researchers, students, and practitioners. As the effectiveness of BIM has been widely accepted in the worldwide “Architecture, Engineering, Construction” (AEC) industry, there is an urgent need to establish a synergy between BIM educated and practitioners in Kosovo likewise. This necessarily leads towards finding more intensive and suitable approaches and tools, for an integrated solution through the education system; in particular, to offer worldwide BIM’s practices into sustainable AEC education programs, curricula and/or courses.

Virtually, the most of the Technical Faculties within universities of Kosovo pretermit viability of BIM in teaching strategy and plan to overcome the barriers to integration of BIM into the curriculum. Through conducted questionnaire to students was surveyed the current state of BIM integration at higher education curricula of Sustainable Architecture and Construction (SAC) programs. Based upon their answers, came out the recommendation to increase the appraiser’s knowledge for BIM in curricula, followed up by new sustainable didactical concepts and awareness, which will energize the commencement of BIM into SAC programs and establish graduates, equipped with the necessary knowledge and skills for BIM software before they get promoted in professional calling.

KEY-WORDS

”Building Information Modeling” (BIM), education process, curricula, questionnaire.
1. INTRODUCTION

In despite an extensive number of studies regarding the methods for integration on Building Information Modeling (BIM) in process of education for Architecture, Engineering and Construction (AEC), a lack of consensus remains among researchers and practitioners regarding the applications of BIM in context of education in Kosovo (Nushi and Jakupi, 2017).

One of the essentials of sustainable architecture and construction education like the other technical education is to remain up to date and follow current trends. In this sense is it important to see the needs of an increased population, followed by the increased clamour for a better lifestyle. Thus, the great demand for the natural resources, such as sunlight, atmosphere, water, land (includes all minerals) along with all vegetation has the oblique report with the Architectural, Engineering, and Construction (AEC) industry demands.

A tendency of meeting such demands and their reports are also appearing in the capital of Kosovo, Pristina, due to rapid expansion and growth, in 1910 with 18,000 habitats to nearly more than 550,000 residents recently (Nushi et al., 2011). Particularly the social-political changes within the last two decades have influenced the demands for the achievement of architecture and sustainable construction. Thus, the nexus between AEC industry and political power, in fact, habitats, areas-contexts, and costs are not proportional developed.

Furthermore, misuse of sustainable building assessment in Kosovo by environmental and building state management or/and other institutions, during entire life-cycle of buildings, creates an e effect that regardless of some comparable alternatives of buildings assessment management methods, so in default of appropriate BIM system. In this regard, the sustainable development in KS needs a holistic approach and integrated establishment. In this direction, learning methods in higher education of architecture and construction should follow changes as though worldwide contemporary education systems.

Thus, the knowledge or skill acquired by instruction or to study architecture and construction requires today also the activity or process of studying, practicing, being taught for the achievements in BIM or/and other digital tools. Today is crucial for the universities to introduce BIM as education promising tool since in general, it helps to create opportunities for advanced collaboration and project coordination in a triangle, client: designer: builder; and develop building design documentation and construction processes.

To satisfy the building technology demands for AEC industry with BIM, many educative institutions around the world have integrated BIM into their academic programs of AEC (Pikas et al., 2013). The problem of identifying and solving social, environmental, cultural and economic prosperity must be supported. From the educative and academic point of view, the quality of life of habitats, education needs, unemployment, environmental degradation and increased needs for natural resources makes important transformations to the way of long-term planning, learning and justifying decisions in AEC industry. In this context, the educational system in Kosovo can be exploited in developing bringing sustainable AEC industry, e.g. through the educational process of using BIM tool implementation into new concepts for design and construction issues.

The BIM tool in education processes is measured by research questionnaire. The overview of questionnaire outcome leads to the conclusion that the design of sustainable built environment curriculum in relation to current and future needs of the Kosovo AEC industry and BIM implementation is pending. Thus, its quantitative and qualitative data provide an exploratory look at the views of a group of 30 students. Their personal interest is to foresee, plan and actively promote the implementation of BIM skills into SAC high education processes.

2. LITERATURE REVIEW AND CONTEXTUAL COMPARISON

The approbation of BIM in educational programs is relatively a new effort. BIM teaching programs are being offered in many universities; nevertheless, they are usually narrowed to software training, gained in different education/training manner, illuminated or taught by professional associations, universities or commercial companies. Recruitment for BIM specific role directly from education also varies. In a lot of cases, there are no – suitably qualified and/or skilled candidates available to be considered as have relevant experience. In general in Kosovo, the education systems clearly do not produce BIM skilled candidates needed by AEC industry now. Skills training is not the sole concern of the AEC industry itself but should be approached at e.g. secondary and higher education levels, to develop and promote the training, learning and research aspects of BIM knowledge.

Researchers (Ghosh and Parfitt, 2015) have identified the need to incorporate BIM into university teaching to equip engineering graduates with an adequate understanding of BIM concepts and they identified engineers’ BIM skills as a means to help achieve the successful uptake of BIM within the AEC industry. BIM can be incorporated into university education in four different ways. The options could be as follows: (1) introducing a BIM elective or organizing a workshop, (2) introducing an advanced BIM focused degree program, (3) restructuring the existing curriculum to include BIM, and (4) integrating BIM into the existing SAC curriculum (Ghosh and Parfitt, 2015).

Researchers (Gier, 2007) have concluded that BIM is a helpful teaching tool for construction estimation and quantity take-off skills and highly contribute to design comprehension skills and understanding of construction materials, methods, and processes. In Australia, many Technical and Further Education (TAFE) institutions are providing BIM courses within AEC programs. However, this education is inclined towards the use of particular BIM software packages with little consideration to BIM management topic or the procedures for working in a collaborative environment (NATSPEC, 2015). The findings of the studies (Wu and Issa, 2013; Liu and Hatipkarasulu, 2014) from the members of Associated Schools of Construction (ASC) in the US indicates that 54% of the programs had dedicated and fully developed
BIM classes in their curriculum. To learn more, the authors studied BIM education status in the US, i.e. BIM courses in Construction Engineering and Management programs (CE&M), as shown in Table 1.

The research study (Hoang and Bedrick, 2015) also highlighted that some countries have already prepared to deal with the integration while others have yet to start this integration process into AEC programs. However, in Kosovo, studies on the status of BIM implementation in universities and in the AEC industry are not very common. The BIM skilled and educated members are lacking in formal and informal settings. Universities across Kosovo are facing a serious lack of focus on overall construction engineering and management skills and education. It believed that 60-70% of Architectural Engineers and Civil Engineering graduates join construction firms and rest to the other domains such as design and consulting firms. Therefore, there is a need to introduce and teach BIM into education process at the university level in order to prepare skilled students to apply BIM on projects when there is a need to introduce and teach BIM into education process at the university level.

<table>
<thead>
<tr>
<th>Course names</th>
<th>Institutions</th>
<th>Credit Hours</th>
<th>Description/Purpose of course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Information system</td>
<td>Auburn University</td>
<td>3</td>
<td>To explore, create and implement BIM that exists in mobile and/or cloud application forms.</td>
</tr>
<tr>
<td>CNMG 2318, BIM</td>
<td>The University of Arkansas at Little</td>
<td>3</td>
<td>To focus on utilizing basic functions of BIM for residential and commercial construction and examine geometry, spatial relationships, geographic information, quantities and properties of building components. To ease quantity takes off by virtual models of buildings.</td>
</tr>
<tr>
<td>MCM-602, Construction Information Modeling</td>
<td>Philadelphia University</td>
<td>3</td>
<td>Integrated practice and BIM are given comprehensive coverage, about the application of the software to the actualization of the built form.</td>
</tr>
<tr>
<td>CM 414, Virtual Construction</td>
<td>University of Washington</td>
<td>3</td>
<td>To examine the use of BIM for managing the construction process and facilitating collaboration among project participants.</td>
</tr>
<tr>
<td>CE 570, BIM Collaborative CM</td>
<td>University of Southern California</td>
<td>3</td>
<td>To provide some hands-on experience with advanced BIM solution and to provide some knowledge about how to work in BIM teams and learn to different aspects of BIM-based scheduling, estimating and collaborative modeling.</td>
</tr>
<tr>
<td>ECIV 309, BIM in Construction</td>
<td>Montana State University</td>
<td>2</td>
<td>To develop working knowledge of BIM and its software applications and to understand BIM role in AEC industry.</td>
</tr>
<tr>
<td>CGT 46000, BIM for commercial construction</td>
<td>Purdue University</td>
<td>3</td>
<td>Study of commercial job site planning and coordination. Trade coordination, visualization, and communication are also emphasized.</td>
</tr>
</tbody>
</table>

The following research questions to achieve this aim are: what are students’ knowledge and understandings in range of terms and concepts related to BIM tool? Why do they arise the needs for BIM skills? What are practical needs stated of the students are for BIM to be used in SAC field? Where do the students look for BIM education/training? Are they sufficiently aware of a BIM tool? Why do they require the BIM education/training? Do they understand future processes of BIM? The findings and arguments of this research will have a pedagogical impact since generally the recommendation to implement BIM into the curriculum for design, building construction, and urban planning will potentially increase AEC industry performance in Kosovo. Particularly in relation to current and future needs of AEC industry in Kosovo will influence versus to educators and professional bodies seeking to respond to the fast-technological, thus to legitimate for systematically embedding long-term design and construction curricula.

3. RESEARCH METHODOLOGY

The research was done by distributing the questionnaire to 30 architecture students within the University of Pristina. They have been told that the trend of the questionnaire is to get information on whether or not to use BIM for the needs of the AEC industry. The analysis and evaluation of the 30 responses collected were presented as summarized in the tables and
graphs shown below. Overview of basic information about architectural students’ views on the definitions and practices of BIM, the use of BIM in the field of design, engineering and construction, the use of BIM for the sustainable development of AEC industry; the type of guidelines, programs or syllabuses to be more effective in encouraging more educational institutions to adopt the BIM usage practices, etc.

The questionnaire consists of the following subsection: 1) Personal Information, 2) University Information, 3) Evaluation of current state of BIM integration in the SAC curriculum, and 4) the barriers to integrating BIM into SAC curriculum., 12 questions and 9 sub-question, such are some of them: what are their main sources of information on BIM practices? Is there any connection between the knowledge that students have with the needs of the AEC industry for sustainable development? What ideas, people or events have influenced the most in developing their interests in the skills they would gain with BIM? In general, they are encouraged to comment and/or clarify about sources of educational strategies or new curricula and programs that would make it easier for them to engage in sustainable design, engineering, and construction in Kosovo.

4. ANALYSIS AND DISCUSSION

BIM’s knowledge and skills that can be accumulated through the education process, measured by a questionnaire realized for students, suggest that integrating BIM’s knowledge into compulsory education within the syllabuses, since BIM’s technology awareness was provided energy and derives immediate activity for effective action in the AEC field; professionals with the skills acquired by BIM contribute directly to the AEC filed, consequently in the sustainable development of the country; and other issues that help the population’s awareness of the impact of AEC’s industry on their environmental, social, economic and cultural values. In order to be able to perform fully in their communities and at work, students generally welcome the growing knowledge and skills that BIM will provide. Moreover, the skills gained with BIM will increase their chances of finding jobs. Meanwhile, employers can expect vice versa, so young people can be able to contribute effectively and effectively to the AEC industry.

The respondents – students were asked about the sources of information they collected about BIM. The majority of respondents, 57% (17 respondents), had collected it from personal research; 34% (10 respondents) had collected the information from literature and/or media; whereas remained 3 respondents collected from workshops, cooperators, and courses. None of the respondents had a chance to collect the information about BIM from any investors during their on-job training, as shown in Figure 1.

The respondents answered on how much of BIM levels incorporated in projects as shown in Figure 2. It is clearly seen that majority of them, 43% (13 respondents) did not had or not used BIM into their projects during their studies or elsewhere; 33% (10 respondents) incorporated BIM into few of projects; whereas, 17% (5 respondents) had experience of using BIM application both in professional and amateur settings.

During this research, it was very important to define whether respondents’ taken additional professional education about BIM has been applied during their studies. The majority, 37% (11 respondents) have applied occasionally gathered education about BIM; whereas 27% (8 respondents) used it very often; hence almost the same, 23% (7 respondents) never used or/had a knowledge to applied BIM during their studies (Figure 3).

Furthermore, in the Figure 4 is shown the relation of respondents’ answer about if is BIM included into their projects, and if so is it incorporated more into individual building or public, or are those invested privately or by the government?
In response to multiple choice questions about what strategy should be used to integrate codes into BIM programs for AEC, or to what extent are the following types of considerations in BIM strategies to expedite processes in the AEC industry, were found that most, 80% of respondents answered that energy and water; for material selection, 90% of respondents; etc., as shown in Table 2.

Table 2: Summary of Responses - types of considerations at BIM strategies.

<table>
<thead>
<tr>
<th>Land use</th>
<th>Land impact</th>
<th>Energy and water</th>
<th>Selection of materials</th>
<th>Well-being</th>
<th>Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>12%</td>
<td>3</td>
<td>9%</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>6</td>
<td>18%</td>
<td>4</td>
<td>12%</td>
<td>3</td>
<td>9%</td>
</tr>
<tr>
<td>20</td>
<td>60%</td>
<td>23</td>
<td>79%</td>
<td>25</td>
<td>85%</td>
</tr>
</tbody>
</table>

To what extent are the following factors that could be hampering the recognition of your profession or the incorporation of BIM strategies for sustainable construction in your professional work, questions such as (1) Lack of education; (2) Lack of expression of student interest; (3) Lack of teamwork; (4) Lack of understanding of recognition; (5) Sustainable construction is expensive; (6) Sustainable design support; (7) Lack of »green« materials; (8) Legal problems that offer material guarantees or non-standardized methods, (9) not safe from getting information about AEC, the respondent's answers are as shown in the Table 3.

The questioner consisted a final part of multiple choice questions, such as: what strategy should be used to integrate BIM into AEC program; was found that respondent suggested teaching standalone BIM course, and/or to incorporate BIM topics/contents into conventional AEC courses; or/and suggested organizing BIM workshops in AEC program; to restructure the existing AEC curriculum to include BIM; or/and to student learn BIM skills by themselves. Also, in response to the question on the current status of BIM education within the AEC curricula in their universities, 67% believed that it was at very low level. Furthermore, 57% considered high level that use of BIM could improve AEC industry in near future.

5. CONCLUSIONS

It overtakes that the implantation of BIM skills might be taken through education establishments lies across organizations, government departments, and professional institutions and in this case through the education processes within Universities. BIM education could motivate usage of inventive technologies such as BIM, that society and environment demand contemporary construction. But, the current practice of BIM skills and knowledge is fragmented in University of Pristina's curricula. It is important that BIM implementation within curricula is just a step towards sustainable social development in general in regards to requirements for professionals at AEC industry.

6. RECOMMENDATIONS

At the educational national level, the University of Pristina should build student's capacities, young skilled BIM people for their future SAC field career choices. The future graduates of the architectural and building construction will face easily increased level of social and environmental needs for SAC conscience and thinking; in such a foundation, students of architecture within University of Pristina should be better placed to stimulate their professional studies within a broader context and assisted by certain technologies, such as BIM skills building industry experience and future planning and designing, meanwhile fulfilling the needs of building AEC industry in Kosovo.
Therefore, it should be a plan to create awareness for BIM integration into AEC curricula and to look forward to increasing BIM skilled teaching capacities too. In that regards, besides teaching methodologies, the workshops, training, and conferences should be arranged in order to share the knowledge among SAC students, teachers and international practices. Also, traditional SAC curriculum structure needs to be revised, hence it is extremely important for the university to develop new and comprehensive BIM course or to develop the other best strategy for integrating BIM into SAC programs, based on current national and international AEC industry needs.

REFERENCES


