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**Title: Using gamification to enhance BIM learning experience. An Introduction****1 – Aims**

The main goal of this tutorial is to address to the possibility of using gamification to enhance and stimulate BIM learning experience. Gamification can give a stimulus to initial BIM learning in an intuitive way, encouraging the use of this construction process. The familiarity of Minecraft and Lego to youngsters encourages their learning and the continuity to more complex systems.

**2 - Learning methodology**

The teacher will give an explanation about the use gamification to enhance BIM learning experience.

**3 - Tutorial duration**

The task described in this tutorial will be carried out in a computer classroom.

It will last 30 minutes.

**4 – Necessary teaching resources**

Computer room with PCs with internet access.

**5– Contents & tutorial****5.1 – Introduction****5.2 – Learning BIM early concepts using Minecraft****5.3 – Learning BIM early concepts using Lego****6- Deliverables**

No delivery is required in this tutorial.

**7- What we have learned**

How the gamification, namely Lego and Minecraft, can be used to learn more complex systems as BIM.

**8 - Files to use in this tutorial**

No files were used in this tutorial.

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### 5.1 – Introduction

New teaching methodologies with a more active participation of students are increasingly present in the educational field. One of the best known is gamification, which refers to learning through play. In addition, gamification, in the form of competition, is a proven method for enhancing BIM teaching and learning in higher education and providing students with authentic assessments (Hosseini *et al.*, 2021). The use of gamification mechanics presents motivating, efficient means of visual communication in human-human, human-tool and human-model interactions. Standardisation of these interaction types at an information level is significant to BIM in order for a common language to be spoken by participants (Lo *et al.*, 2014).

In this context, two possible ways to learn/teach the principles of BIM are through LEGO and Minecraft tools, and they are highly effective in teaching BIM to adults and children alike.

### 5.2 – Learning BIM early concepts using Minecraft

Minecraft is a 3D game where players can create their own environments with pixelated blocks (simulating material textures) in an x, y, z coordinate system. The game allows the participant players to create or play to survive. Playing in the create mode, it is possible to design 3D building or other objects as illustrated in Figure 1 and 2.



Figure 1: Example of Minecraft exterior building (<https://www.minecraft.net/pt-pt/article/build-it--brick->)



Figure 2: Example of Minecraft interior building (<https://www.minecraft.net/pt-pt/article/build-it--brick->)

Nevertheless, the realism of the 3D construction is not high, as a pixelized block construction and limited materials textures and dimensions are used. However, there are some comments and articles about the existence of some similarities between the Minecraft concept and the BIM concept, even with statements that BIM is an “adult version of Minecraft”. It is possible to understand the idea that the concept of collaborative construction at a young age can provide some skills through games.

Taking this into account, a project called “BeIMCraft” has developed the idea of adding a *mod*<sup>1</sup>, and a way of learning, to Minecraft adding the skill of Built Environment Information Modelling. It will enable structures and all the elements involved in the construction to be planned and developed, bringing the digital and real world closer together (Figure 3). As an example, the game requires students to first place foundations when creating their building, and there are even height limitations before stability becomes a concern.



Figure 3: Example of Minecraft interior building (<https://www.minecraft.net/pt-pt/article/build-it--brick->)

According to the project presentation, there are several overlaps between Minecraft and BIM such as: Collaborative working; 3D Modelling; Virtual Reality Applications; Planning; Sustainability; Health & Safety; Structural Stability; Comfort and Costing.

An article on the <https://constructible.trimble.com> website indicates that learning the principles of BIM using Minecraft have some more benefits such as:

- Common Data Environments (CDEs) allowing collaboration
- Comfortable with the idea of working and operating in 3D environments
- Learning to appreciate how costs are assigned to an asset
- Understanding of time management and deadlines
- Understanding of site constraints

<sup>1</sup> *Mod* is a modification in the game or software designed by the players.

- Increased awareness of construction sustainability

According to the article, the goal of the game is to “reflect the interdisciplinary nature and requirement for collaboration with the built environment’s supply chain by challenging pupils to consider planning issues, health and safety risk, structural aspects, sustainability, and cost when creating their 3D world.”

The lack of recent news and articles about this “*mod*” and about the idea of teaching and learning BIM using the Minecraft game led us to think that this remains in development by the researchers. However, this suggestion opens a cluster of opportunities and a new way of starting to acquire skills in a funny way, developing these skills over time.

In conclusion, Minecraft software can probably allow an introductory learning to the BIM concept in an intuitive way, encouraging the use of this construction process. The familiarity of Minecraft to youngsters encourages their learning and the continuity to more complex systems.

### 5.3 - Learning BIM early concepts using LEGO

LEGO is a physical building toy that uses a set of pieces that fit together and that allow players to build houses (Figure 4), cars and planes, among other types of constructions, in a reduced scale for children (or adults) to play with and, at the same time as well as to gain multiple physical skills. The constructive principle and the 3D model are native in the LEGO toy. This is possible to see in the LEGO building instructions type (Figure 5).



Figure 4: Example of LEGO building construction (<https://www.lego.com>)



Figure 5: Example of LEGO instructions (<https://www.minecraft.net/pt-pt/article/build-it--brick->)

An article on the <https://graphisoft.com/> website about “Open BIM Exercise Gives Hands-On Education” explains a “BIM Lego Experience” created as part of the BIM Education program. In the experience the participants have 2D models instructions and Legos as their materials. Later, the participants received BIM files in an IFC format using individual “color” files. With this, the participants realise the power of BIM to help reducing errors and also how difficult it can be to build a project from traditional 2D printed drawings.

Another experience of approaching LEGO to the BIM concept is presented by Huang (2020). A LEGO house was adjusted and converted into a BIM model and a set of 2D construction drawings of the LEGO house was generated for a comparison between the traditional 2D approach and the BIM. Students started the experience using only the 2D models. Later, using Navisworks, they completed the LEGO house with the help of BIM and compared the difference of the methodology.

Nowadays, in the digital field, LEGO also provides a recent 3D building software called “BrickLink Studio” available at [www.bricklink.com](http://www.bricklink.com) which replaces “LEGO Digital Designer” which is still available at [www.lego.com/en-us/idd](http://www.lego.com/en-us/idd). The software enables people to build, render, and create instructions with virtual LEGO bricks. Figure 6 shows an example of the Disney castle designed with LEGO pieces on studio 2.0.

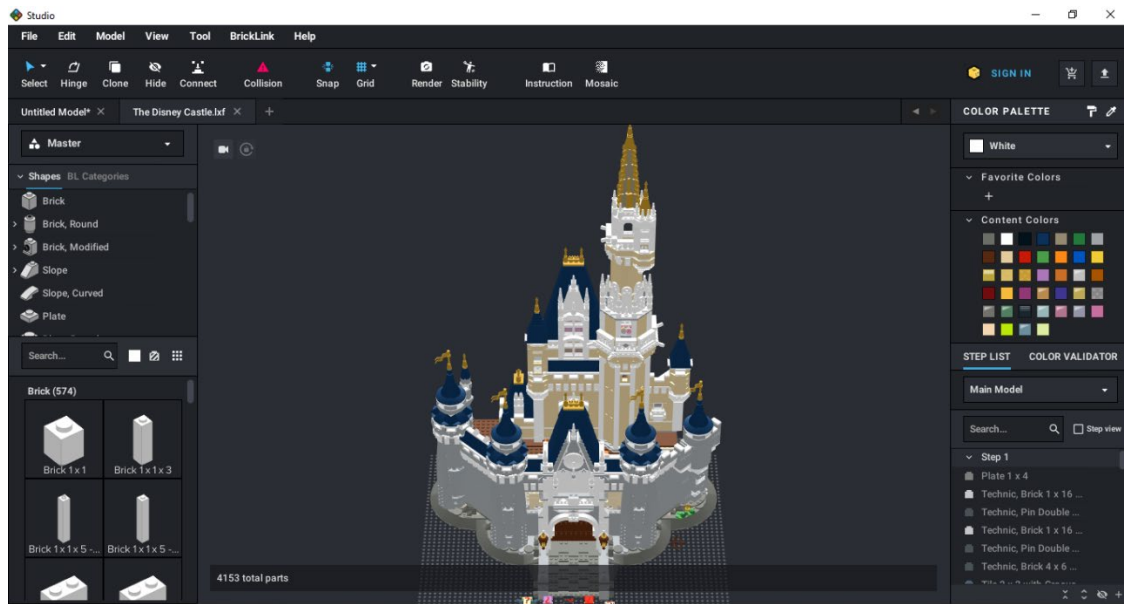


Figure 6: Example of studio 2.0 construction

In conclusion, LEGO concept and software can also allow an introductory learning to the BIM concept using gamification. The use of LEGO elements that youngsters can recognize seems to be an effective method for learning the BIM concept.

## References

Hosseini et al., *BIM Teaching and Learning Handbook - Implementation for Students and Educators*, Routledge, London, 2021 DOI: <https://doi.org/10.1201/9780367855192>

Lo et al., *BIM-Gamification*, Presentation at Construction Industry Council, Vocational Training Council, Hong Kong Institute of Building Information Modelling, 2014

## websites

[www.constructible.trimble.com](http://www.constructible.trimble.com)

[www.lego.com](http://www.lego.com) [www.graphisoft.com](http://www.graphisoft.com)

[www.bricklink.com](http://www.bricklink.com)