NEW TECHNOLOGIES FOR STIMULATION OF STUDENT ENGAGEMENT

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Abstract
In this work, a seminar based on Problem Based Learning (PBL) was proposed in order to test the student engagement at university via collaborative and game learning, specifically in the subject Material's Science of the Degree in Technical Architecture at the University of the Basque Country. The main objective of the seminar was to achieve one of the most important goals of the PBL methodology: to keep the students engaged and motivated, making the teaching-learning process more effective and successful. For this aim, new technologies and gaming learning were the basis employed in this seminar.

Keywords: PBL, student engagement, gaming learning, new technologies, experimental subjects.

1 INTRODUCTION
In the last decades, both Project and Problem Based Learning (PBL) have gained significant attention and pre- and primary schools as well as secondary schools have started to apply this methodology into their education system. PBL consists on solving real life problems by the students, keeping their motivation high along with the development of many useful and meaningful skills [1, 2]. In this way, students learn in a more practical manner, obtaining better competences for both their personal and professional future lives. Student engagement is the main responsible for the aforementioned results. In fact, one of the most important goals of the PBL is to keep the students engaged, maintaining them motivated and making the teaching-learning process more effective.

Student engagement consists on making the student experience better and enhancing the learning outcomes optimizing the invested time, effort and other relevant resources [3]. Apart from the involvement of the students, the interaction between three dimensions is required: behavioral, emotional and cognitive engagement.

The dimension of the engagement behaviour is based on the compliance of the students with the rules of attendance and participation. The second dimension is the emotional engagement, in which students must show interest and enjoyment through self-learning. Finally, in terms of cognitive engagement, students must acquire interest in their learning beyond what is required in class and show desire to face the educational challenges proposed.

However, at high-school and university the educational system tends to change. Indeed, traditional teaching methods still thrive, making the learners lose their interest and, hence, their motivation. In fact, students often do not attend the classes due to the lack of motivation and engagement the professors transmit. This behavior enhances the non-attendance of other classmates and usually leads to academic failure, which means both reputational and financial inconvenience for the involved institution and also personal frustration.

For all the aforementioned reasons, the seminar presented in this paper was carried out in order to study the influence of the student engagement on the teaching-learning process. As previously mentioned,

2 METHODOLOGY
The seminar was performed in a second year class of ten students of the Degree in Technical Architecture at the University of the Basque Country, by two PhD students who were not their usual professors. The chosen topic was related with the subject Material’s Science and focused on composite materials for construction. The students had a previous knowledge on conventional building materials, but did not have any information about composites and bio-composites.
The seminar was divided into three parts: first of all, a theoretical brief and conceptual part was presented in a *Prezi* format in order to give some information about the selected topic. Moreover, a quiz via *Quizizz* application was then carried out to test the student's comprehension. Afterwards, and linked to the classification of the quiz, a practical activity of searching was proposed. In this activity, four different buildings and projects were presented, and according to the previous ranking the students could choose the building they wanted to analyze. The analysis was mainly focused on the composite, bio-composite and conventional materials that had been employed for their construction and after around twenty minutes, they had to present their results briefly to their mates. Once the theoretical and the practical parts were done, a final round table discussion was performed. In this way, they reflected about the advantages and inconveniences that the mentioned materials had and they could express their own opinion about the employment of these materials in construction as future technical architects.

### 3 RESULTS

The students showed great interest on the seminar even days before the seminar was given. The observed behaviors during the different parts of the seminar have been reported in the following subsections.

#### 3.1 Theoretical part

##### 3.1.1 Presentation

During the presentation the students presented a receptive behaviour. The *Prezi* presenting format was new for them and this made them keep engaged. Fig. 1 shows the general view of the presentation. The design was selected on purpose since it was directly related to Architecture. As seen in Fig. 2, short sentences and numerous images and diagrams were employed in order to achieve the highest possible comprehension level. The content was not too extensive with the aim of not leading them to confusion. At the end of the presentation, they asked some questions, which were a proof of having been attentive.

![Figure 1. General view of the presentation.](image1)

![Figure 2. One of the presentation slides.](image2)
3.1.2 Quiz – comprehension game

The students were then asked to form groups, as they were for other assignments of the subject, and to take out their tablets, mobile phones or computers. They were given a code and they were able to join the quiz game on the board by Quizizz online application. The four groups of two-three students played the quiz excitedly, as the classification was simultaneously shown on the board and was changing continuously. They showed high motivation and competitiveness, but always being respectful to the rest of the classmates.

The good statistics of the quiz answers showed that the learners had understood the theoretical seminar content. All the groups had a problem in one of the questions with the display of the images and they could not answer it correctly. However, from the remaining seven questions, the maximum wrong answers were two. Table 1 shows the statistics of the played game and the score of each group.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Player</th>
<th>Average Time</th>
<th>Score</th>
<th>Accuracy</th>
<th>Correct/Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group 1</td>
<td>7</td>
<td>6430</td>
<td>88 %</td>
<td>7/8</td>
</tr>
<tr>
<td>2</td>
<td>Group 2</td>
<td>7</td>
<td>5540</td>
<td>75 %</td>
<td>6/8</td>
</tr>
<tr>
<td>3</td>
<td>Group 3</td>
<td>9</td>
<td>5420</td>
<td>75 %</td>
<td>6/8</td>
</tr>
<tr>
<td>4</td>
<td>Group 4</td>
<td>15</td>
<td>4310</td>
<td>63 %</td>
<td>5/8</td>
</tr>
</tbody>
</table>

The overview of the answers in Table 2 leads to think that question 4 was not properly understood since it was a common mistake for the 75 % of the groups, but after asking the students, it was clarified that the comprehension of the heading was the problem more than the content.

<table>
<thead>
<tr>
<th>Questions</th>
<th># Correct</th>
<th># Incorrect</th>
<th># Unattempted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>24</td>
<td>8</td>
<td>0</td>
</tr>
</tbody>
</table>

| ACCURACY  | 75 %      |

3.2 Practical part

After the comprehension game, a practical activity was proposed in order to embrace all the previous information. Following the rank in Table 1 Group 1 was the first choosing their building for analysis. The proposed buildings were previously selected after a search by the PhD students in order to ensure finding the wanted information. These constructions are shown in Figure 3. It can be seen that the buildings are very different and each one has each own characteristics and materials.

The students were surprised when presenting them these constructions and indecisive about which one to choose. Afterwards, they looked up on the internet for around twenty minutes and prepared a short explanation about the selected building and the reasons for the materials used for its construction.
In this part of the seminar, they also presented very participative, they even asked questions to the speaking groups, sometimes just out of curiosity. The involvement of the whole group was also observed in this activity and this helped the seminar to be more fluent.

### 3.3 Round table discussion

After the work done and all the received information during this seminar, two main questions were suggested in order to make the students reflect. These two questions were the following ones: “After this seminar, which advantages/disadvantages do you find to the composite and bio-composite materials?” and “After the analysis, which materials would you choose for your construction, the traditional ones or bio-composites?” The students again presented a highly participatory attitude and the discussion took longer than the expected time. However, very interesting opinions and conclusions were brought up and all the classmates expressed their own thoughts and ideas.

After finishing the discussion, the speakers asked for a feedback and the evaluation of the students was very positive. They said they had found the seminar really entertaining and engaging, and they thanked the speakers for their work.

### 4 CONCLUSIONS

In this work the effect of the implementation of a PBL-based seminar was studied on the behaviour and results of second year students of the Degree in Architecture of the University of the Basque Country. This seminar was prepared for the subject of Material’s Science and the topic was focused on composites and biocomposite materials applied to construction.

On the one hand, the students showed great interest on the seminar and an increased understanding on the subject. In addition, a high participation and teamwork was achieved, which would be useful for their future workplaces. On the other hand, it was seen that students, despite the previous ignorance on this topic, obtained good results with 75 % of correct answers, which proved their good understanding.

In conclusion, the implementation of the PBL method in a seminar is a good alternative to the traditional method of teaching in order to increase students’ motivation for continuous learning and acquisition of critical thoughts. However, it has only been tested in a small group of 10 students so it would be interesting to consider doing it in larger groups in the future.

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REFERENCES

