VISITS AND VIDEOS OF CONSTRUCTION SITES AND FACILITIES AS A TEACHING TOOL IN INDUSTRIAL CONSTRUCTION SUBJECTS

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Abstract

The visits to construction sites and facilities are a very valuable teaching tool in technical degrees, since they allow to in-situ see the straight application of the theoretical knowledge learned in the classroom and contextualize them. They usually are quite well received by the students, demanded and very appropriate in the last courses, since they allow knowing the environment, bring the industry closer to the University, and place the student in the real scenario of their future job placement. The main drawback is that they are complex to organize and carry out for various reasons, which increases its value.

In the particular case of construction works, the moment in which the site is visited is crucial, since it will allow to appreciate some or other concepts (that later will be hidden due to the development of the work): earthworks, foundation, structural assembly, roof placement, concrete placement, construction of framing and walls, installation of pipes and wiring, urbanization, ... Thus, to understand the construction process in a global way, it is necessary to observe different works at different times, which is very complicated to get for a student throughout his academic career.

The main objective of this work is to make visits to sites and installations of construction companies, record them and, with the compiled material, edit a series of videos where elements and constructive processes are reflected and explained. These videos will be used as a teaching tool.

The aim is to obtain a quantitative evaluation of suitability as teaching tools of (i) visits to sites and installations of companies dedicated to the industrial construction sector, and (ii) videos recorded in those visits where concrete concepts are shown. To this end, surveys are conducted to students of the Degree in Mechanical Engineering (in different courses) and the Master's Degree in Industrial Engineering, before and after the use of these tools (visits and videos), to quantify the impact they have had on the teaching-learning process.

During this academic year 2018/2019, a first phase is being carried out, consisting of the realization of a first batch of 8 visits, the edition of between 10 and 15 videos, its use as a teaching tool and the conduct of surveys of opinion of the students. Six different subjects participate in the project, so it concerns more than 100 students. The preliminary results of this project show that visits and videos are very motivating tools for students. In subsequent courses, we intend to continue with visits and videos, given that the initial results obtained, which are presented here, are positive.

Keywords: Construction, visits, videos, motivation.

1 INTRODUCTION

In the current educational context, teaching practices at the university level have changed significantly based on the acquisition of skills or the greater weight given to the practical classes. The inclusion of the media, new technologies, and extracurricular activities (outside the classroom) in the teaching-learning process means improvements in teacher training. The emergence of new learning environments has been observed, such as visits to companies, more oriented to the professional practice of the students so that they learn to develop their critical thinking and promotes their self-learning [1,2]. At all levels of teaching, and for a long time, visits have been used as a teaching tool.

Its benefits are many, in the first place they are activities that awaken the interest of the student, because the monotony of the formative process in the classroom is broken, real contents are observed that the student has only been able to imagine or appreciate in photographs and diagrams, a multitude of transversal contents is discovered, professional skills and attitudes [1,2]. Therefore, the visits to companies are intended to offer students the opportunity to learn in practice what has been
addressed in the contents shown in the classroom, facilitating their learning process and promoting interdisciplinary work [3], as well as student motivation [4]. They are specific activities, their organization is complex, they carry a cost and for all this they are usually scarce, being carried out in the order of one (or two) maximum per student and academic year, according to level and center. In the university sphere, visits are even more valuable and even scarcer, if possible. They are more valuable because they not only serve as a teaching activity but also to deepen the characteristics of the profession and the business environment in which the student is going to develop. The student can establish relationships in the future with these companies, as worker, client or supplier. Therefore, they can be a great step in the formation of students and in their preparation for professional practice.

On the other hand, they also have numerous advantages for the teacher, because it favors the updating of their knowledge by maintaining a fluid and frequent contact with companies, something that directly affects the quality of teaching.

As indicated above and given the complexity of conducting visits to companies, the creation of audiovisual material is another option to improve student learning and increase their motivation [5, 6]. The multimedia teaching material raises several advantages such as the elimination of space-time barriers, which makes it possible to reproduce the teaching video when desired and as many times as desired [7] making the student the protagonist of their learning.

The objective of this work is to observe the impact that active learning methodologies (such as conducting visits to companies and the creation of multimedia teaching material consisting of recordings made in visits to works and installations) have in the teaching-learning process of the subjects of the mention in industrial construction of both Bachelor’s Degree and Master in Mechanical Engineering.

2 METHODOLOGY

This project is being developed in two University programs of the Higher Polytechnic School of Jaén, Bachelor and Master Degrees in Mechanical Engineering, involving 6 different subjects and a total of 100 students.

To set out the activities of the project, an initial survey was carried out to the students, with the aim of knowing the number of visits to companies that had made throughout their programs, as well as their opinion before this kind of activities. Once the surveys were evaluated, the project's teaching staff established a preliminary proposal of visits taking into account their activity and the accessibility of the company. In many cases, to visit small or medium-sized companies in the area, it is essential to have contacts, with which to be able to agree on visits. It is necessary to understand that, for the company, the visits can suppose disturbance in their activity, reason why it is important to plan them beforehand, and to offer a compensation for the time and the inconveniences caused, as it can be the diffusion of commercial material between the visitors and their acquaintances.

For all this, there is a fundamental figure in our universities, such as that of the associate professor, a figure who must combine his teaching work with an intense professional activity. As a result of this work, contacts are usually made in companies in the sector, which can be used to agree visits.

Based on this figure, a series of visits was planned to different types of companies and facilities, which are listed in Table 1.

The transmission of knowledge and learning during a visit does not only depend on the facilities visited, but also plays an important role how the installations are presented. For this reason, it is always advisable to count on the visit with the participation of the engineers who designed, built and maintain the facilities, as well as with the owners or CEO of the companies (to the extent possible).

For the preparation of teaching videos of these visits, it was decided to make recordings with drones since from the air the dimensions of the buildings and facilities, their distribution and organization are better appreciated. Photographs and videos with handycam were also captured.

It was necessary to draft and sign agreements with the companies visited, as the current legislation in Spain requires it for the flight of drones in private facilities. These documents also established some guidelines on the videos to be generated and guarantees for the company regarding industrial secrecy.
Once the visits were made, the videos were assembled and edited using specific software for that purpose. The evaluation of these teaching experiences (visits and videos) has been made through surveys.

Table 1. Visits made during the academic year 2018 / 2019.

<table>
<thead>
<tr>
<th>Group</th>
<th>Name</th>
<th>Location</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction companies</td>
<td>Cantera Manuel Alba</td>
<td>Torredelcampo (Jaén)</td>
<td>Aggregate extraction</td>
</tr>
<tr>
<td></td>
<td>Cemosa</td>
<td>Jaén</td>
<td>Construction quality Laboratory</td>
</tr>
<tr>
<td></td>
<td>Transformados y ferralla Moral</td>
<td>Torredelcampo (Jaén)</td>
<td>Steel reinforcement</td>
</tr>
<tr>
<td></td>
<td>Ferroplast</td>
<td>Atarfe (Granada)</td>
<td>Sanitation pipes</td>
</tr>
<tr>
<td></td>
<td>Probisa</td>
<td>Atarfe (Granada)</td>
<td>Asphalts and road grounds</td>
</tr>
<tr>
<td>Sites and infrastructures</td>
<td>Jaén Plaza</td>
<td>Jaén</td>
<td>Mall (under construction)</td>
</tr>
<tr>
<td></td>
<td>Nuevo Jaén</td>
<td>Jaén</td>
<td>Industrial state</td>
</tr>
<tr>
<td></td>
<td>Geolit</td>
<td>Mengíbar (Jaén)</td>
<td>Technology park</td>
</tr>
<tr>
<td>Industrial companies</td>
<td>Nª Sra. del Pilar</td>
<td>Villacarrillo (Jaén)</td>
<td>Olive oil extraction</td>
</tr>
<tr>
<td></td>
<td>Congana</td>
<td>Bedmar (Jaén)</td>
<td>Agri-food packaging</td>
</tr>
<tr>
<td></td>
<td>Bandesur</td>
<td>Alcalá la Real (Jaén)</td>
<td>Food plastic trays</td>
</tr>
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<td></td>
<td>Flexia films</td>
<td>Alcalá la Real (Jaén)</td>
<td>Food plastic film</td>
</tr>
<tr>
<td></td>
<td>Smurfit</td>
<td>Mengíbar (Jaén)</td>
<td>Paper mill</td>
</tr>
<tr>
<td></td>
<td>Sedinfra</td>
<td>Atarfe (Granada)</td>
<td>Road signage</td>
</tr>
</tbody>
</table>

3 RESULTS

This text presents the results of the first year of the project, in which a total amount of 10 visits were done. The students who have participated are those at the final year of the Bachelor’s Degree in Mechanical Engineering, specifically those studying the subjects of the mention in industrial construction (“Steel structures”, “Concrete structures” and “Construction and industrial architecture”), what means a group of 35 students. Some visits were also done with the students of “Structures and industrial construction”, core subject from the 2nd year at the Master in Industrial Engineering, concerning another 30 students.

In relation to the visits listed in Table 1, four of them have not yet been able to be carried out for different reasons. The remaining eight have been made during this academic year. Some of the companies visited did not allow the recording of images in their facilities, so videos of those visits can not be generated. In any case, there were only four companies that refused, so there is enough material collected to generate a series of teaching videos.

Up to date, 2 videos have been generated with the material recorded during visits. One of them is about the visit to the oil cooperative (focused on the structures and buildings that these industries require) and the other one describes the structural elements of an industrial construction. Videos has been used at sessions with the students of “Theory of structures”, core subject at 3rd year of the Bachelor’s Degree in Mechanical Engineering, so another 50 people more has participated in the project.

There is an intention, throughout the project (in later academic years) to prepare a thematic video for each of the visits, and also generate between 8 and 10 short specific videos, which can be used in the classroom as tools for certain topics, even in some others subjects, as “Construction materials”.

The results of these teaching activities have been quantified through anonymous surveys to the participating students. First, an initial survey is carried out, prior to the completion of the activities, and a final or subsequent one, with questions aimed at quantifying the opinion of the students on the suitability of these teaching activities. They are actually two final surveys, one for students who have
experienced the visits, and another for those who have learned with videos as a tool. The number of participants in each survey is different due to the participation of different groups and the totally voluntary nature of the surveys.

3.1 Initial survey

Sample size was 39 students, its distribution about age and gender is shown at Fig. 1.

![Figure 1. Sample distribution about age and gender of initial survey.](image)

The results (Fig. 2 and 3) show that most students at 3rd course has not done a visit as a teaching activity. They do not expect to do many of them, and strongly recommend to do more (between 6 and 10 at the end of the Degree). Videos are a more used tool, although they are not used as often as students think they should be. The majority opinion is that both visits and videos are very useful teaching tools, if not indispensable, for the acquisition of knowledge and skills related to the degree.

![Figure 2. Results of initial survey 1/2.](image)
3.2 Final surveys

Two different final surveys were done, one to the students participating in the visits, and another to the group of students attending the videos. Both are aimed to evaluate the goodness of the activities.

3.2.1 Final survey: Visits.

Sample size was 35 students, its distribution about age and gender is shown at Fig. 4.

![Figure 3. Results of initial survey 2/2.](image)

![Figure 4. Sample distribution about age and gender of visits final survey.](image)
Figure 5. Results of visits final survey.
The results (Fig. 5) are overwhelming. The visits have a big influence on the learning process for every issue discussed. The students think this activity is very positive and strongly recommend it.

### 3.2.2 Final survey: Videos.

Sample size was 41 students, its distribution about age and gender is shown at Fig. 6.

*Figure 6. Sample distribution about age and gender of videos final survey.*

The results are shown in Fig. 7 and 8. Videos seem to be a good teaching tool, because they have an important and positive influence on the learning process. Students agree with the use of this videos, and recommend it to the Faculty.

*Figure 7. Results of videos final survey 1/2.*
4 CONCLUSIONS

In the current framework of university education, activities that facilitate the active learning of students must be carried out. To organize visits to companies is clearly one of the tasks with greater performance with respect to learning. The results obtained demonstrate that these activities are good teaching tools, because they help the student to understand concepts, observe skills and attitudes that they will have to develop in their professional future.

It is noted that, once the visits are made, the students appreciate them even more as a teaching activity, and strongly recommend their use. With this methodology it has been possible to achieve high involvement of the students, as well as a high level of satisfaction with it.

Videos recorded during the visits are also valuable teaching tools. Can be used for particular concepts or to show the facilities, when there is no possibility of repeating the visits.

These results encourage to continue planning and developing these activities.

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REFERENCES


