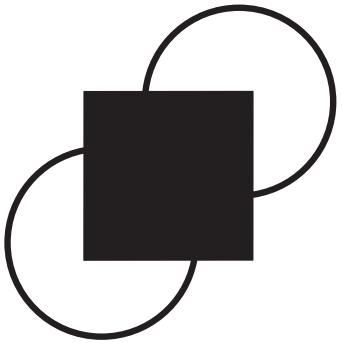
iCERi 2022

15TH INTERNATIONAL CONFERENCE OF EDUCATION, RESEARCH AND INNOVATION

CONFERENCE PROCEEDINGS

7-9 NOVEMBER 2022
iated.org/iceri



iCERi 2022

15TH INTERNATIONAL CONFERENCE OF EDUCATION, RESEARCH AND INNOVATION

CONFERENCE PROCEEDINGS

7-9 NOVEMBER 2022
iated.org/iceri

Published by
IATED Academy
iated.org

ICERI2022 Proceedings
15th International Conference of Education, Research and Innovation
November 7th-9th, 2022
Seville, Spain

Edited by
Luis Gómez Chova, *University of Valencia, Spain*
Agustín López Martínez, *University of Barcelona, Spain*
Joanna Lees, *CEU Cardinal Herrera University, Spain*

DOI: 10.21125/iceri.2022
ISBN: 978-84-09-45476-1
ISSN: 2340-1095

Book cover designed by J.L. Bernat

CREATION OF VIDEOS BY STUDENTS AS A WAY TO PROMOTE LEARNING IN THE AREA OF MECHANICS: AN EXPERIENCE IN HIGHER EDUCATION

J.E. Ribeiro[1,2], F. Silva[1,3], P.M. Barros[1,4]

[1]ESTiG, Instituto Politécnico de Bragança (PORTUGAL)
[2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança (PORTUGAL)
[3]FibEnTech and GeoBioTec-UBI (PORTUGAL)
[4]Centro de Investigação em Educação Básica (CIEB), Instituto Politécnico de Bragança (PORTUGAL)

Abstract

The degree courses in Mechanical Engineering and Technology and Industrial Management of Polytechnic Institute of Bragança (Portugal) include in the 2nd semester of the 2nd year of their study plan, the course units of Mechanical Technology I and Manufacturing Processes I, respectively. The contents of these course units are mostly theoretical, so it is important to find approaches that motivate the students and involve them directly in their learning. The creation of videos for later presentation to colleagues can fulfil this role, as it requires students to search, interpret, select and organize information about the contents and reflect on the best way to transmit it to their peers. Within the mentioned course units, in one of the academic years in which classes were essentially online due to the pandemic, it was proposed to the students the creation, in group, two videos (each one at a different stage of the semester), with the themes assigned by the teacher so that, as a whole, they would cover all the contents that it was essential to explore. The following steps were followed: (i) research on the theme and production of the video by each group; (ii) sharing the videos with classmates; (iii) extra-class viewing of the videos produced by classmates; (iv) students answering general questions about the videos they watched; (v) brief oral presentation in a class by each group about the video produced; (vi) class discussion on the themes of the videos, based on questions posed by the students, and (vii) an evaluation test on the themes covered. Only when all the steps concerning the videos produced in the first phase were fulfilled did we proceed to the preparation of the videos for the second phase, following again the whole process described above. We consider that, with this methodology, the students were more motivated and started to have a more active role in the classes, becoming also (together with the teacher who had the role of an advisor) responsible for the learning of the class, as they contributed with their work and questions to the exploration of the contents. We underline that the described approach, besides promoting the acquisition and deepening of knowledge about the course unit contents, contributed to the development, by the students, of several transversal skills, which can be useful in their daily life or in their professional future.

Keywords: Higher education, videos creation, learning, mechanics.

1 INTRODUCTION

Higher education, in addition to providing theoretical and practical knowledge within the area of training of the course, will be much more enriching if the work within the scope of the course units (CUs) simultaneously stimulates the development of transversal skills. Indeed, since the implementation of the Bologna process, it is assumed that students play the role of protagonists in the teaching-learning process, making the commitment to teaching based on active learning and promoting student autonomy one of the challenges for teachers [1]. This challenge becomes even more pressing when teaching CUs in which the contents are mostly theoretical, as is the case with Mechanical Technology I and Manufacturing Processes I of the Mechanical Engineering and Technology and Industrial Management Bachelor courses of a northern Portuguese Institution. In the 2019/2020 academic year, when the pandemic was still in context and with classes running online, it was considered that the creation of videos by the students themselves, for later presentation to their colleagues and serving as a basis for the exploration of the contents in class, would be a motivating approach and one that would allow students to be directly involved in learning from a personal and collective point of view. This paper describes the strategy followed and its context and presents some of the student's opinions about the process.

2 METHODOLOGY

This study was carried out within the CUs of Mechanical Technology I and Manufacturing Processes I, in the 2nd year of the Bachelor's degree in Mechanical Engineering and Technology and Industrial Management, respectively. In the following sub-points, the context and the participants are explained and the adopted research methodology is indicated, with regard to the collection of information and data analysis.

2.1 Study context and participants

The Mechanical Technology I and Manufacturing Processes I CUs are taught together, the fundamental contents being casting manufacturing processes and metal plastic forming manufacturing processes. The two CUs were taught in the second semester of the 2019/2020 academic year, which began at the end of February 2020, corresponding to the period of isolation due to the pandemic caused by COVID-19. Thus, classes took place online using the Zoom platform. Given the impossibility of teaching face-to-face classes and being able to use the laboratories in practical classes, a didactic approach was chosen in which some principles of the flipped classroom were applied [2].

It was proposed to the students to make in groups (up to four elements) two videos (duration between 15 and 20 minutes) on topics that fit in the CUs' program, based on information provided by the teacher, and through other research on the internet or other documents. The topics were assigned by the teacher and the videos were made at two different times: Phase 1 - Casting processes and Phase 2 - Plastic forming processes for metals. All groups made a video in each of the phases. After the creation of the videos, the students shared them with their colleagues on an agreed date, through a common platform, existing in the Institution, and to which all students had access. The objective of this procedure was for all students to view the videos in an extra-class environment, according to a previously defined schedule, as three videos per class would be discussed.

In the classes that focused on the discussion of the videos, the students started by answering an online questionnaire (duration of 15 minutes) with three questions about the videos they had watched outside the classroom. The questions were all of the same types, but adapted to each theme: a) Briefly summarize the video "Theme", focusing, in addition to other aspects, on the contents covered; b) Indicate two questions to ask colleagues about the video "Theme"; c) Evaluate the video "Theme" (positive/negative aspects).

Then, the group's spokesperson gave a brief presentation (5 minutes) on the topic covered in the video. In the remaining time of the class (approximately 100 minutes), a period of discussion was opened on the topics of the videos, where the students could ask some of the questions they formulated in the answer to the questionnaire. At the end of each of the phases, an online summative assessment test was carried out on the topics covered.

In summary, in each of the phases, the steps described in Fig. 1 were followed.

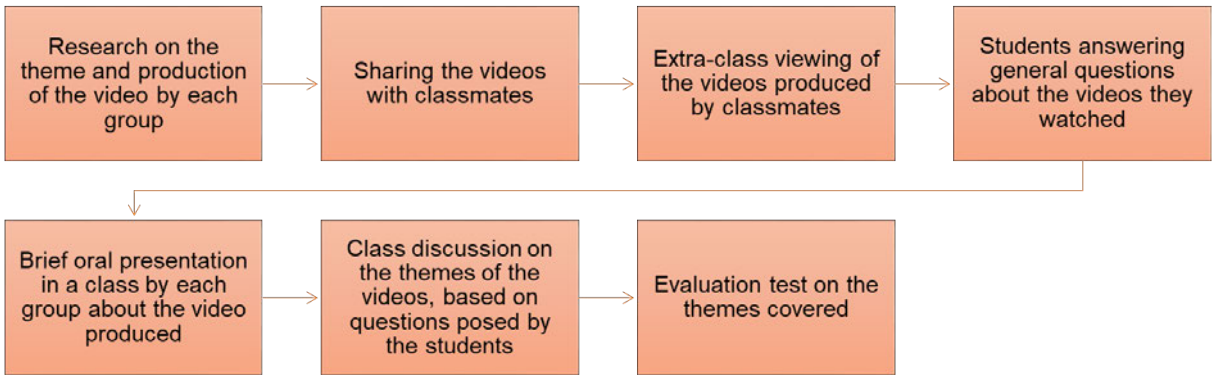


Figure 1. Stages of the experiment performed.

It should be noted that only when all the steps related to the videos produced in the first phase were completed, did the preparation of the videos for the second phase begin, following again the entire process described here.

2.2 Methods of information collecting and data analysis

The evaluation of the experience carried out is based on the observations made by the class teacher (participant observer status) throughout the process, on the student's productions, and on a quiz, applied at the end of the semester. In addition to general information on personal and academic aspects, the aim was to find out the students' opinions on the preparation of the videos from a scientific point of view, the difficulties in making and producing them, the group, and the work carried out, the means used to communicate with peers, the difficulties in making the presentation and answering the questions of colleagues, the videos and colleagues' presentations, and the online tests relating to the videos. The students were also asked to point out the strategies they considered important to maintain in the CU, to focus on the aspects they liked most and least in the CU, as well as suggestions and aspects to change in the CU with a view to improving learning. This article focuses only on some of the aspects of the results obtained.

In the closed-ended answers, students expressed their opinion on several items, based on a Likert scale of four levels: 1 - Fully disagree (FD); 2 - Disagree (D); 3 - Agree (A) and 4 - Fully agree (FA).

In the analysis of the quiz data, descriptive statistical techniques were used in the case of closed-ended answers, namely the calculation of frequencies organized into tables as a way of structuring and summarising the information. In the case of open-ended questions, categories were defined *a posteriori*, according to the answers given.

3 RESULTS

In this section, we present some excerpts from the students' productions and their opinion on the preparation of the group's videos, on the videos and class presentations of classmates, and on the online quizzes.

3.1 Students productions

In phase 1 - Casting processes - students had to make videos on the topics: steel production, aluminum alloys production, how to obtain a casting, sand molding, design casting, metallic or permanent molding, lost wax molding, casting defects. The topics of Phase 2 - Processes of plastic forming of metals - were: forging, extrusion, rolling, presses and punching.

In Fig. 2 and in Fig. 3, we can view an extract of videos of each of the phases.

Figure 2. Phase 1 - Video of design casting.

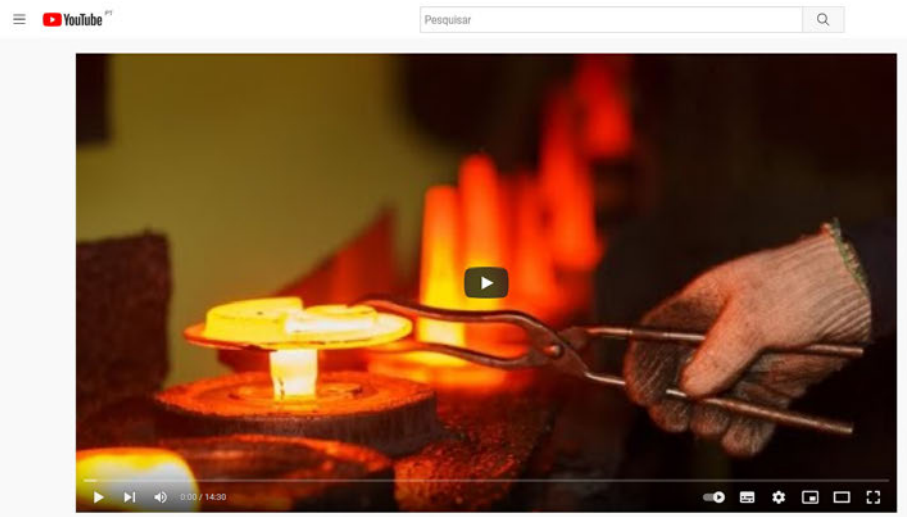


Figure 3. Phase 2 - Video about Forging.

Regarding the technical aspects, in general, the students did not show great difficulty in preparing the videos. The teacher provided a guide for creating a video of a PowerPoint presentation and suggested making it available through the Educast platform [3]. However, students were free to choose the platform they found most convenient. Thus, some made it available through Educast or other platforms, such as YouTube.

3.2 The students' point of view on the experience performed

Relatively to creation of the videos (Tab. 1), although 63.6% of the students do not consider that they learned more than if the teacher had explained the contents themselves, almost all of them agree or fully agree that having to make the video helped them to understand the contents of the subjects better (95.5%) and that the research carried out was quite thorough (100%). In addition, more than three quarters consider that they became more motivated (86.4%) and went further in the research than the teacher requested (88.6%). In this process, the students' difficulties were mainly in selecting the appropriate material to organize the videos and in the correct use of technical terms (52.3% and 43.2% respectively agree or strongly agree that they had difficulties).

Table 1. Students' opinions on the creation of the videos.

My opinion on the development of videos from a scientific point of view	*FD/D (%)*	*A/FA (%)*
I did a thorough search on the subject	0.0	100.0
I learned more than if the teacher had exposed the contents	63.6	36.4
I had a hard time understanding the content I had to cover	72.7	27.3
I became interested in the topic and went further in my research than the professor asked me to	11.4	88.6
I used different research sources (internet, books, and technical/scientific papers)	6.8	93.2
I had difficulties selecting the appropriate material to organize the videos	45.5	52.3
I had difficulties in the correct use of technical terms	52.3	43.2
Making the videos motivated me to the CU	11.4	86.4
Having to make the video helped me to better understand the content on the topics	4.5	95.5

FD - Fully disagree; D - Disagree; A - Agree; FA - Fully agree.

Regarding the student's opinion about the videos made by their colleagues and their respective presentations in class (Tab. 2), as in the previous case, 61.4% of the students consider that this methodology improved their attention in relation to the classes in which the exposition is carried out by the teacher. However, more than 90% agree or more agree that, in addition to the debate held at the end of the presentations, it was important for their learning (95.5%) and that they actively participated in questions to colleagues (90.9%).

Table 2. Students' opinions on their peers' videos.

My opinion on my colleagues' videos and their presentations	FD/D (%)	A/FA (%)
It increased my motivation for the CU	13.6	86.4
I found it more difficult to understand the contents	72.7	27.3
I actively participated in the presentations by asking questions to colleagues	9.1	90.9
I was more attentive than I would have been if the presentation was made by the teacher	61.4	36.4
The debate that took place at the end of my presentations was important for my learning	4.5	95.5
Overall, my colleagues' presentations were explicit	4.5	93.2

FD - Fully disagree; D - Disagree; A - Agree; FA - Fully agree.

The online quizzes, carried out at the end of the presentations, contributed to the students paying more attention to the viewing of the videos before the classes (93.2% agree or strongly agree), although 75% consider that they would probably also watch them if they did not have this evaluation (Tab. 3). Overall the students had no difficulty in working with the tool to carry out the quizzes, but about half of them expressed some difficulty in answering the questions posed in the quizzes. According to the observations of the teacher during these classes, this difficulty was due to the fact that some of the students had difficulty summarising and marking the positive/negative aspects without having to watch the videos again. Perhaps the fact that they had to watch three videos at a time affected their performance, or the attention students said they had paid to watch them was not enough for them to answer the quiz efficiently.

Table 3. Students' views on the online quizzes.

My opinion on online quizzes relating to videos	FD/D (%)	A/FA (%)
Having to do this quiz made me watch the videos with some attention	6.8	93.2
I had some difficulty answering the questions	43.2	56.8
It was easy to understand how the “online tests” tool worked	4.5	95.5
If there were no such quizzes I would probably not watch the videos	75.0	25.0

FD - Fully disagree; D - Disagree; A - Agree; FA - Fully agree.

4 CONCLUSIONS

The methodology used, in addition to the motivational aspects, contributed to the students having a more active role during the classes, sharing with the teacher, who had the role of guide, the responsibility for their learning, and that of the class. It should be noted, that by making the videos, making the presentations, and choosing the questions to ask the classmates the students influenced the classroom dynamics and the very exploration of the contents.

As expected, during the process, some students had difficulties in selecting the appropriate material to organize the videos (52.3%) or in the correct use of technical terms (43.2%), which also allows evolution in terms of skills when these difficulties were overcome, even with the help of the teacher. Even though they recognized the important contribution of the preparation of the videos to their learning (e.g. 95.5% agreed or totally agreed that having to produce the video helped them to better understand the contents of the themes), most students (63.6%) disagreed or totally disagreed that they learned more from the preparation of the videos than if the teacher had explained the contents. This somewhat contradictory perception may be due to the fact that students have not yet disconnected from the traditional expository teaching that may have been a constant throughout their schooling. A similar perspective, linked to the need for the theoretical exposition of the contents by the teacher, was also observed in the studies of Barros and Fernandes [4] and Barros [5] when, within the scope of linear algebra and analytic geometry CUs of higher education courses, a teaching methodology was tried out in order to promote a less transmissive and more student-centered teaching.

Thus, it can be concluded that the described approach, besides promoting the acquisition and deepening of knowledge about the CU contents, can contribute to the student's development of several transversal skills, such as the sense of responsibility, organization, argumentation, and communication skills, among others, that may be useful in their daily life, in other CUs or in their professional future.

REFERENCES

[1] K. Caballero and A. Bolívar, “El professorado universitário como docente: hacia una identidade profesional que integre docência e investigacion,” *Revista de Docencia Universitaria*, vol 13, no. 1, pp. 57-77, 2015.

[2] O. Ölmefors and J. Scheffel, "High school student perspectives on flipped classroom learning", *Pedagogy, Culture & Society*, pp. 1-18, 2021.

[3] https://educast.fccn.pt/ (accessed on 22 September 2022).

[4] P.M. Barros and J.A. Fernandes, “Ensino e aprendizagem de álgebra linear: não vai dar primeiro a teoria?!,” in *V Encontro International de Formação na Docência* (R. P. Lopes, C. Mesquita, E. M. Silva and M.V. Pires, eds.), pp. 1116-1127, Bragança/Portugal: Instituto Politécnico de Bragança, 2020. Available on (http://hdl.handle.net/10198/20081)

[5] P.M. Barros, “O ensino e a aprendizagem de conceitos de álgebra linear no ensino superior politécnico”, Diss. Universidade do Minho (Portugal), 2018. Available on (https://hdl.handle.net/1822/56688)