EDUCATIONAL INNOVATION: EXPLORING FLIPPED CLASSROOM IN THE CONTEXT OF EXPERIMENTAL PRACTICES

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Abstract

The Flipped Classroom methodology has emerged as an innovative educational approach, particularly at the university level. This pedagogical strategy involves students engaging with pre-assigned study material prior to class, enabling in-person sessions to focus on hands-on activities, meaningful discussions, and practical applications of acquired concepts.

Utilizing the Moodle platform, an adaptable Learning Management System (LMS), enhances the cohesive integration of the Flipped Classroom methodology. Moodle serves as an online space for educators to efficiently create, manage, and distribute educational content, ensuring easy access for students anytime and anywhere. Its adaptability has been exemplified in various pedagogical innovations, encompassing diverse methodologies such as blended learning, collaborative projects, gamification, and creating personalized learning environments. This is substantiated by scholarly articles highlighting Moodle's efficacy across various educational approaches.

Within Moodle, the book resource emerges as a valuable tool, facilitating the creation of diverse materials such as texts, videos, and websites. This interactive resource fosters a visual learning model beneficial for teachers and students.

This study aims to implement the flipped classroom model in the practical sessions of the physics curriculum within the Computer Engineering Degree program at the University of Cordoba. The primary objective is to transition from a conventional teacher-centric classroom structure to one that fosters students' critical and autonomous learning through integrating Information and Communication Technologies (ICTs). Central to this implementation is utilizing the Moodle book, a pivotal tool for creating a comprehensive practice resource. By incorporating explanatory videos, images, theoretical concepts, and evaluation tests, this method seeks to enhance student-teacher interaction, cultivate self-learning skills, and empower students as active contributors to the construction of knowledge, ultimately creating a more adaptable and enriched learning environment.

The results indicate a significant increase in student-teacher interaction, cultivating skills for self-directed learning and empowering students as proactive constructors of knowledge, enhancing their critical thinking acumen. Furthermore, the research has contributed to cultivating competencies enabling students to navigate the experimental practice environment independently, fostering increased adaptability within the learning framework. Additionally, the study has provided supplementary information, enriching comprehension and proficiency in fundamental concepts.

Keywords: Flipped Classroom, Moodle Platform, Experimental Practices, Physic, Teaching-Learning Process.

1 INTRODUCTION

Traditional teaching, the master class, consists of acquiring knowledge at the same time as the lecture, with additional time for the teacher to resolve any doubts. In addition to the above, additional exercises are usually proposed for the students to solve outside of class in order to consolidate the knowledge acquired. The alternative to this method is the Flipped Classroom (FC).

The Flipped Classroom (FC) pedagogical model, the subject of several studies such as those of Bergmann and Sams (2012), Good and Lavigne (2017) or Plota and Karalis (2019) [1]-[3], aims to make students the protagonists of their learning, taking advantage of their motivation as a synergistic factor, preparing the classes themselves outside the classroom, thus going from being passive subjects, in the acquisition of knowledge, to active subjects, favouring the consolidation of knowledge by being able to

allocate class time to resolve doubts [4]. During the COVID-19 pandemic, this pedagogical model gained momentum when distance learning had to be combined with face-to-face learning. Karalis and Raiku (2020) studied this situation in students enrolled at the University of Patras and concluded that teaching methods that combine face-to-face and distance learning improve students' interest and participation in knowledge acquisition [5].

Guerrero (2020) lists the basic steps to be taken to implement the flipped classroom in the classroom [6] and one of them is the preparation of materials and information and communication technologies (ICTs), which play an important role and in particular, the Moodle platform [7]-[9]. The Moodle platform is a teaching system, within the elearning platforms, designed to create and manage learning spaces adapted to the needs of teachers and students that allows the creation of interactive online courses and virtual learning environments. Among the many tools it offers, it is possible to create virtual classrooms, carry out assessments, manage tasks or create educational content. The Moodle book resource is useful for creating study materials and manuals, and its main features include the possibility of including multimedia content and monitoring students' learning progress.

In this study, aided by the Moodle platform and, more specifically, by means of the Moodle Book resource, a book has been implemented to put into practice the Flipped Classroom (FC) teaching method in a laboratory practice class. By means of this tool, the students, in an autonomous way, acquire the knowledge of the physical fundamentals necessary to carry out the exercises during the practical session. To confirm the previous work, reading and acquisition of the concepts, the downloading of the work file for the classroom session was conditioned to the completion of a test with multiple-choice questions, also carried out through the Moodle platform. The experience was carried out in the Physics subject of the Degree in Computer Engineering at the Higher Polytechnic School of the University of Cordoba.

2 METHODOLOGY

The subject chosen to develop the proposed work is a first year subject of the Degree in Computer Engineering, specifically in the practical content of the subject. The first practical of the subject is introductory, where concepts related to the electrostatic field and electric current and direct current circuits are worked on.

The book is made up of only two chapters. The first one deals with concepts related to the electrostatic field such as Coulomb's law, electric field, field lines and electric potential. In this first topic, in addition to the definition of the above concepts, we have dealt with the representation of these concepts by means of images and videos, see Figures 1, 2 and 3.

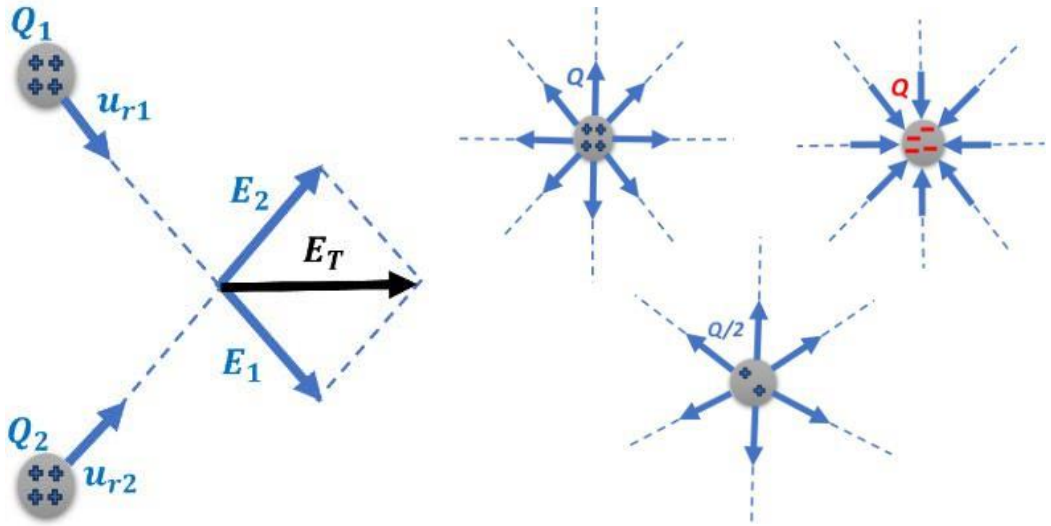
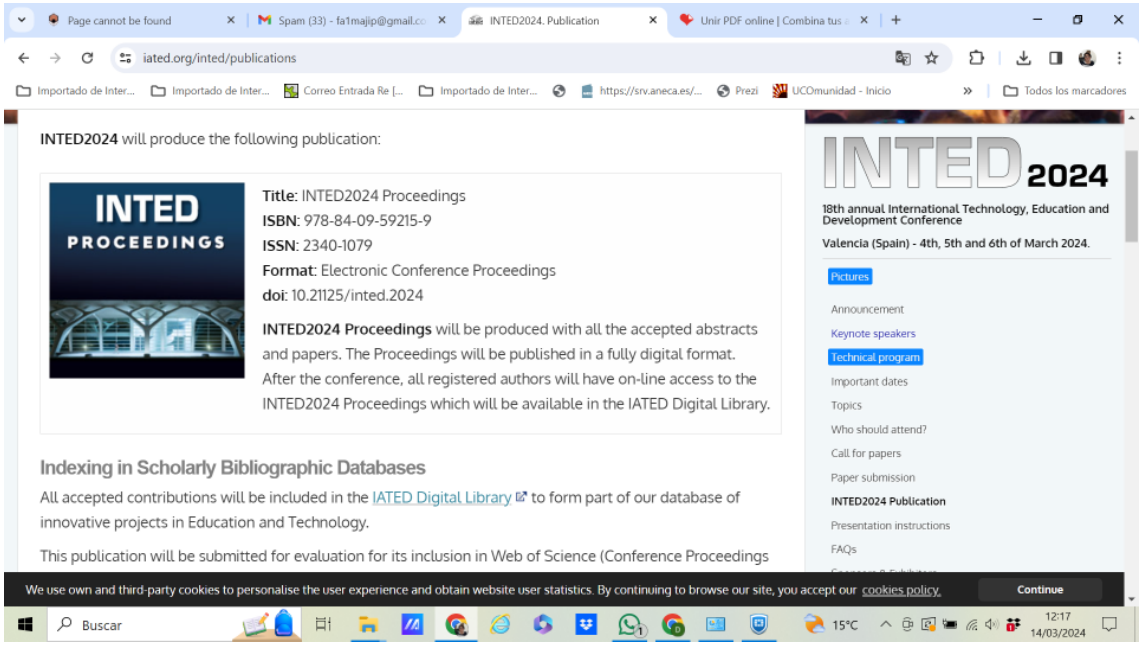


Figure 1: Electric field intensity vector and field lines (own source).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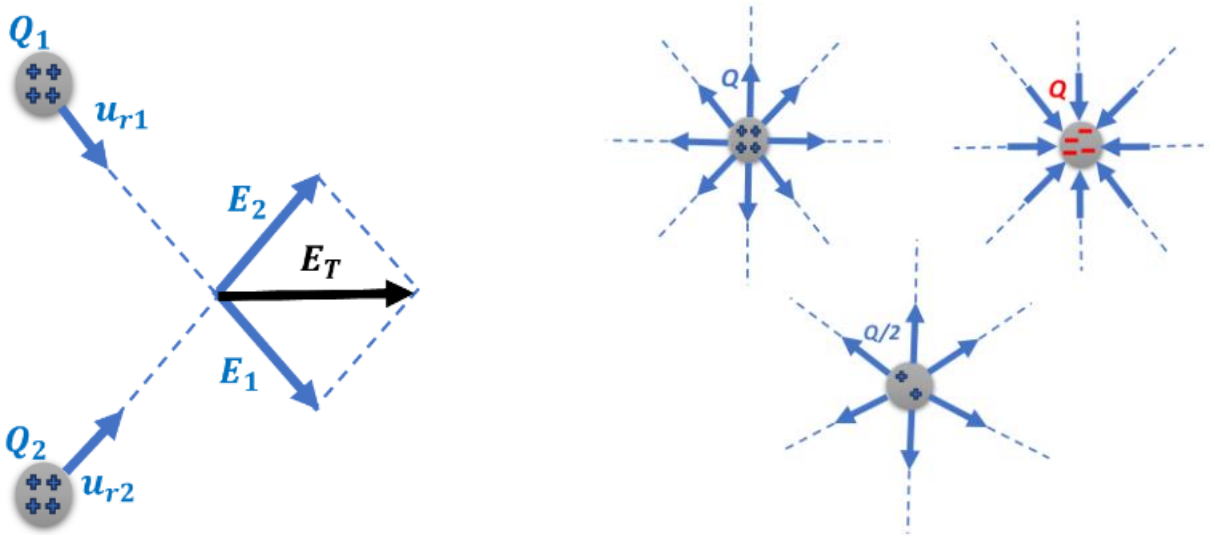

Figure 1: Electric field intensity vector and field lines (own source).

Figure 2: Video electrical interaction and electric field (web YouTube: https://www.youtube.com/watch?v=JMGrcTrwsXI).

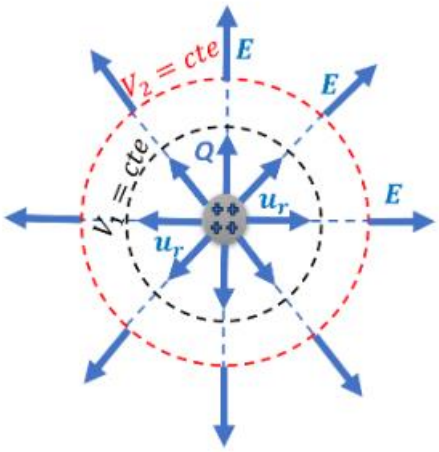

Figure 3: Equipotential surfaces and electric field intensity vector (own source).

In the second topic of the resource book, concepts such as ohm's law, resistor association and Kirchhoff's laws were explained by means of short videos made from resources available on the web. Figure 4 shows an example of short video about Parallel resistance.

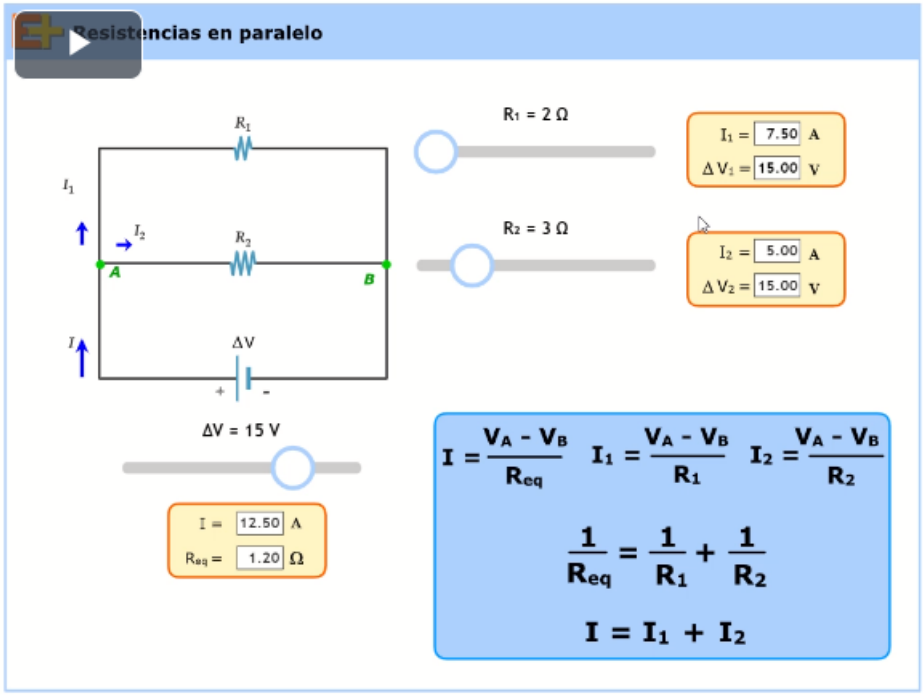

Figure 4: Parallel resistance (Web Educaplus: https://www.educaplus.org/game/resistencias-en-paralelo).

To evaluate the knowledge acquired by the students, at the end of the reading of the book, and once this has been marked in Moodle, the platform itself enables a test, composed of multiple choice or true-false questions, and designed so that each student has multiple attempts, since passing this test conditions the download of the work file in the classroom sessions (Figure 5). In the face-to-face sessions, students put into practice what they have learnt, as well as asking questions that are resolved in groups, both by their classmates and by the teacher.

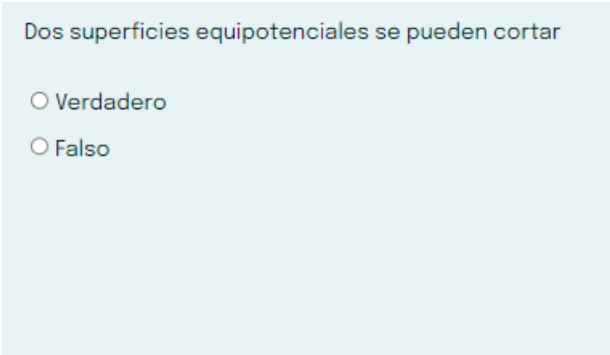

Figure 5: Evaluation test question in Moodle.

3 RESULTS

The students of the Physics course of the Bachelor's Degree in Computer Engineering took the test once the content of the book had been marked as read, which allowed the platform to make the test of acquired knowledge available. The test, as it was a condition for being able to download the work file in the classroom session, was designed so that students could make multiple

attempts. The average mark for the first attempt was 7.55 points, and the distribution of marks is shown in Figure 6.

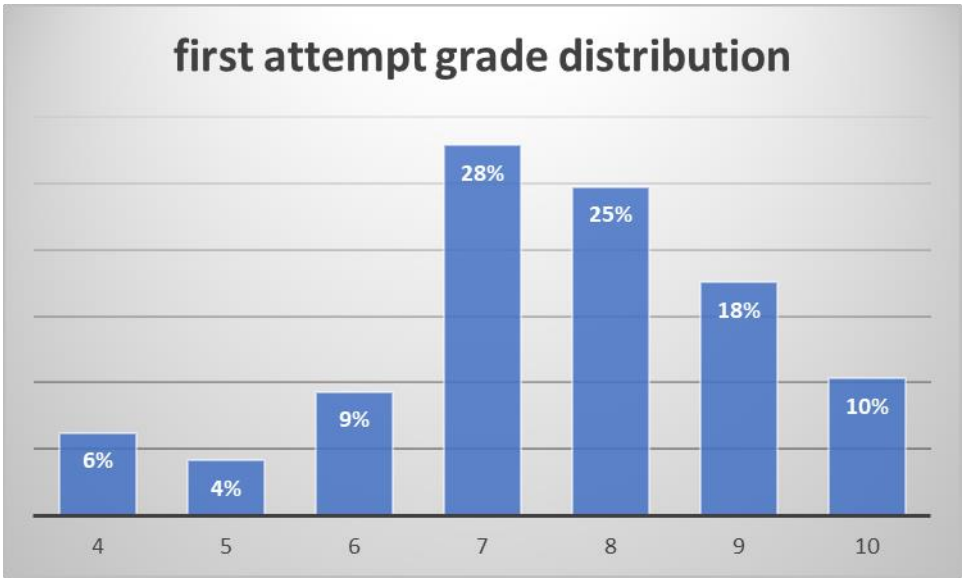

Figure 6: First attempt grade distribution.

According to the results shown in Figure 6, 94% of the students who took the assessment test obtained a score equal to or higher than five points. Eighty per cent of the students obtained a score of 7 points or more, confirming the level of knowledge acquired.

At the end of the first practice session, the students were given a survey to evaluate aspects of the book such as: 1:

1. Does the book adequately address the key contents of the practice?
2. Do you find the information clear and easy to understand?
3. Has it helped improve your skills or academic performance?
4. Do you consider it to be a valuable resource for learning?
5. On a scale of 1 to 10, how would you rate this book in terms of its value as a study resource?
6. Does the visual presentation (graphs, tables, images) facilitate understanding of the concepts?
7. What do you think about the format of the book? Rate from 1 to 10.

Table 1: Results of questions 5 and 7.

Note (question 5)	%	Note (question 7)	%
5	6,7	5	6,7
6	10,0	6	3,3
7	36,7	7	20,0
8	23,3	8	26,7
9	23,3	9	23,3
10	0,0	10	20,0

Table 1 shows the distribution of marks obtained in questions 5 and 7. In the case of question 5, 83% of the marks obtained are equal to or above 7 points. In question 7, the percentage rises to 90%, marks equal to or higher than 7.

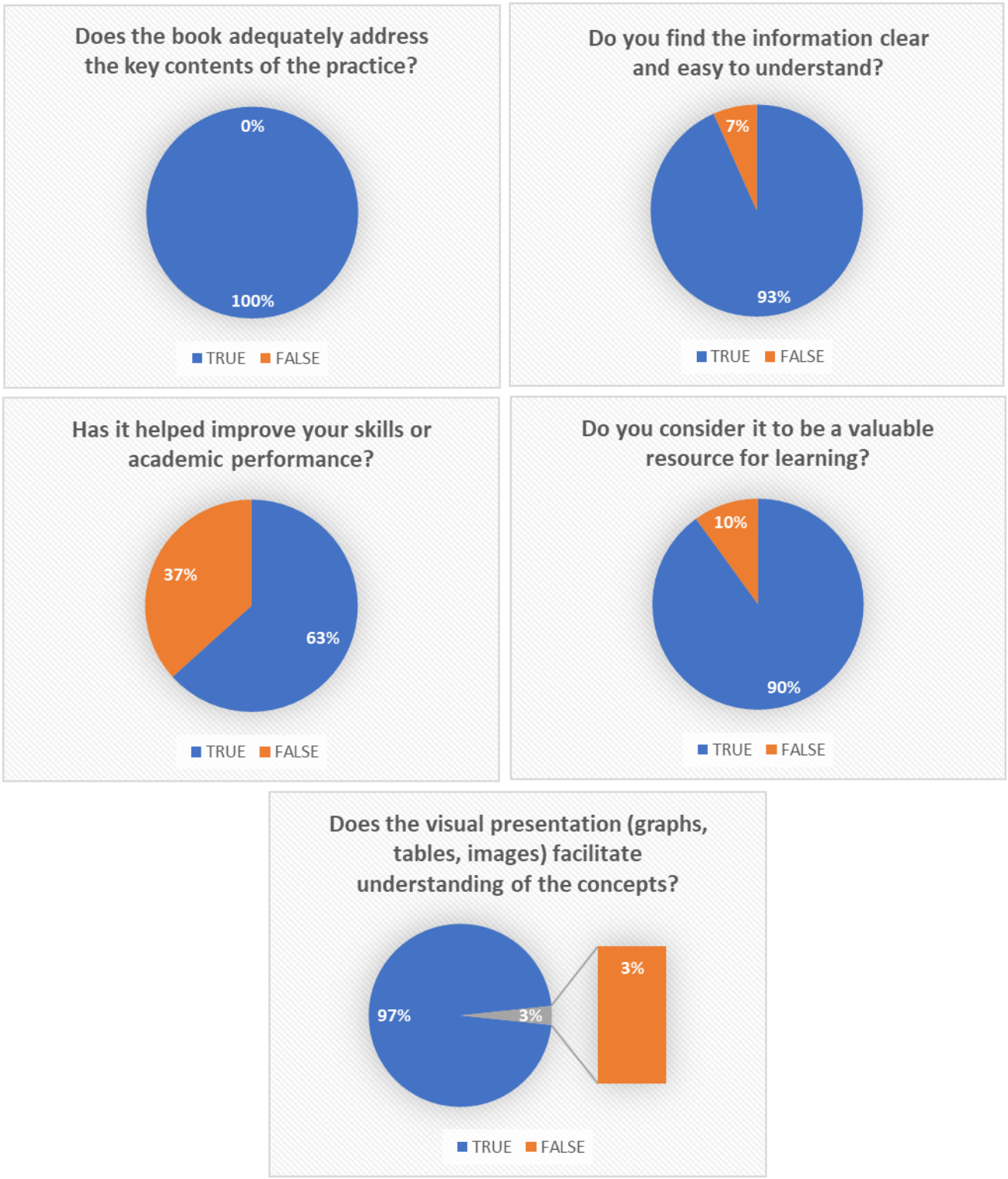

Figure 7: Evaluation survey results.

Figure 7 shows the results of the resource evaluation survey. Overall, the results showed a high level of acceptance, with students highlighting the appropriateness of the contents with the practice carried out in the classroom session, 100%, and 93% of the students considered that the information was clear and easy to understand (question 3). 90% of the answers given to question number 4, consider the Moodle book as a valuable resource for learning. Regarding the representation of the concepts explained, question 6, 97% responded affirmatively.

4 CONCLUSIONS

The inverted classroom considers student motivation to be fundamental to the success of the pedagogical model. In the practice session that this method has been used, it is the first of the course, practically before any classroom class where any theoretical content is taught, even content related to the subject matter being worked on in practice.

The students have rated the experience positively, confirming this in the survey on the evaluation of the resource. The students have mostly valued the format of the resource, online and available at any time through the Moodle platform, as well as the fact that the resources are supported by images, videos and simulations of varied origin, both own source and resources present on the network.

The experience, together with the tool, is applicable to the Physics subject taught in other degrees at the Higher Polytechnic School of the University of Cordoba.

REFERENCES

[1] Bergmann, J., & Sams, A. (2012). Flip Your Classroom: Talk to Every Student in Every ClassEvery Day. Washington DC: International Society for Technology in Education.

[2] Good, T. L., & Lavigne, A. L. (2017). Looking in classroom. New York: Routledge

[3] Plota, D., & Karalis, T. (2019). Organization and implementation of a Flipped Classroom course in the Greek University context. Educational Journal of the University of Patras UNESCO Chair, 6(2), 53-61.

[4] Revista UNIR. (2020). Flipped Classroom, las claves de una metodología rompedora. Revista UNIR, 1-10.

[5] Karalis, T., & Raikou, N. (2020). Teaching at the times of Covid-19: inferences and implications for higher education pedagogy. International Journal of Academic Research in Business and Social Sciences, 10(5), 479-493. http://dx.doi.org/10.6007/IJARBSS/v10-i5/7219.

[6] Guerrero, J. (13 de agosto de 2020). El Aula Invertida, una estrategia ideal para el modelo híbrido o semipresencial. Obtenido de www.https://docentesaldia.com/: https://docentesaldia.com/2020/07/26/el-aula-invertida-una-estrategia-idealpara-el-modelo-hibrido-o-semipresencial/

[7] Triantafyllou, E. (2015). The flipped classroom: Design considerations and moodle. *Using Moodle for supporting flipped classrooms*, 5-12.

[8] Bentabol, A. Esteban, M. Soler, R. Caña (2019) EXPERIENCIA DEL USO DE MOODLE PARA AULA INVERTIDA EN EDUCACIÓN SUPERIOR, Actas ICERI2019, págs. 6193-6198

[9] Martín-Meras, M. L. D., Mancha, A. G., Rodríguez, J. G., Hernández, J., & Málaga, E. J. (2018). Moodle como soporte para Flipped Classroom. In *Campus digitales en la educación superior* (pp. 403-412). Servicio de Publicaciones.