

Student Response Systems in higher education: A comparative analysis using Wooclap platform in economic courses

Sistemas de respuesta en el aula en la educación superior: un análisis comparativo utilizando la plataforma Wooclap en cursos de economía

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Catala, B.; Muñoz-Higueras, D.; & Sanjuán, J. (2024). Student Response Systems in higher education: A comparative analysis using Wooclap platform in economic courses. *Journal of Management and Business Education*, 7(2), 244-260. <https://doi.org/10.35564/jmbe.2024.0014>

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Language: English

Received: 4 December 2023 / Accepted: 21 March 2024

Funding. This work was supported by the Spanish Ministry of Universities through the “Formación de Profesorado Universitario” Programme and by the Project HIECPU/2019/2 of Conselleria de Hacienda y Modelo Económico de la Generalitat Valenciana.

Ethical Statement. The authors confirm that data collection for the research was conducted anonymously, and there was no possibility of identifying the participants. The authors confirm that the research obtained informed consent from participants, explaining the treatment of the provided data.

ABSTRACT

The introduction of technological tools such as student response systems to dynamise classes in higher education has been increasing in recent years, although often without proper monitoring of their effects. This research aims to analyse the main added value of the use of the Wooclap platform in university education, and whether there are differences in its results depending on the heterogeneous characteristics of the courses and groups in which it is applied. To this end, a comparative analysis has been carried out in three different courses in the field of economics at the University of Valencia. In all three courses, questions were introduced in Wooclap during theory classes. Students in the three courses were given an anonymous survey at the end of the course to evaluate the use of this tool. The students were very satisfied with the tool, highlighting that it helps them to maintain their attention, identify the most important concepts, understand and

consolidate them. Furthermore, by means of the Chi-square test, no significant differences were observed in the three groups, from which it can be deduced that beyond the specific characteristics of the course, the profile of the students or the lecturer, this tool can be extrapolated to different contexts and satisfactory results can be expected. The ease of implementation, the possibility of obtaining immediate feedback from students and breaking the monotony of classes are other advantages for lecturers. The conclusions drawn highlight the potential of Wooclap to extend its use in higher education.

Keywords. Student response system, Innovative education, Wooclap, comparative analysis, questionnaire

RESUMEN

La introducción de herramientas tecnológicas como los sistemas de respuesta en el aula para dinamizar las clases en la educación superior ha ido en aumento en los últimos años, aunque a menudo sin un correcto seguimiento de sus efectos. La presente investigación se propone analizar cuál es el principal valor añadido del uso de la plataforma Wooclap en la educación universitaria, y si existen diferencias en sus resultados en función de características heterogéneas de las asignaturas y grupos en los que se aplique. Para ello, se ha llevado a cabo un análisis comparativo en tres asignaturas diferentes del ámbito económico en la Universitat de València. En las tres asignaturas se introdujeron preguntas en Wooclap a lo largo de las clases de teoría. Al alumnado de las tres asignaturas se les pasó una encuesta anónima al finalizar el curso para que valoraran el uso de esta herramienta. El alumnado se muestra muy satisfecho con la herramienta, destacando que les ayuda a mantener la atención, a identificar los conceptos más importantes, entenderlos y consolidarlos. Además, mediante el test de Chi cuadrado, no se aprecian diferencias significativas en los tres grupos, de lo que se deduce que más allá de las características concretas de la asignatura, el perfil de los estudiantes o el profesor, esta herramienta es extrapolable a diferentes contextos cabiendo esperar resultados satisfactorios. Su fácil implementación, la posibilidad de obtener feedback inmediato por parte del alumnado y romper la monotonía de las clases son otras de las ventajas para el profesorado. Las conclusiones extraídas ponen de manifiesto la potencialidad de Wooclap para extender su uso en la educación superior.

Palabras clave. Sistema de respuesta en el aula, Innovación Educativa, Wooclap, análisis comparativo, cuestionario

INTRODUCTION

The higher education scenario requires constant adaptation to the needs of students and the changing demands of society. In this context, marked by the need for innovation to improve the quality of teaching, tools such as active learning methodologies or Student Response Systems (SRS) have shown positive effects on students in terms of engagement and concentration in the classroom (Espejo Leupín, 2016; Tuttle, 2021). On the instructor side, the use of these methodologies increases teaching effectiveness (Kumar & Kumar, 2010).

In the university system, the Covid-19 pandemic has been a catalyst for digital learning, leading to the deployment and popularisation of new learning methodologies, including online tools (Dhawan, 2020). Studies have shown that these tools have made it possible to tailor university teaching to the individual needs of students and have promoted collaborative learning (UNESCO, 2020b). The hasty adaptation to virtual teaching and the use of innovative technologies meant that technological tools such as SRS had to be maintained when returning to face-to-face teaching. This was justified by the evidence of many positive effects on students. However, some studies

have also revealed that the use of these systems requires additional effort and preparation time for the instructor (Zdravkovska et al., 2010).

Among the different existing SRS, the Wooclap platform has experienced an increased use in classrooms (Moreno-Medina et al., 2023). It has been used in different disciplines, demonstrating numerous benefits in terms of motivation, attention, lecturer-student interaction, collective discussion and student inclusion (Braçe-Diko & Garrido-Cumbrera, 2022; Catalina-García & García-Galera, 2022). However, although the literature has shown its positive effects in different educational settings, there is a lack of studies that comparatively analyse its implementation in three different courses, in three different university degrees, but in the same field of study. The study aims to fill this gap by comparing, for the first time in the literature, the use of the Wooclap platform in three courses at the University of Valencia during the academic year 2022-2023. Thus, this is the first study that provides evidence on the impact of SRS in different university courses of the same discipline and is able to answer the following research questions: (1) What is the main added value of the Wooclap platform in university teaching? (2) Are there differences in the introduction of an interactive response tool such as Wooclap in three heterogeneous courses with an economic profile?

This study stands out for providing a comprehensive and novel perspective by comparing the use of Wooclap in different courses and on students with different characteristics. Therefore, this research not only provides new evidence of the positive impact of Wooclap has on teaching, but also establishes a replicable framework of analysis that can be extended to other academic disciplines.

To this end, first, a literature review is conducted based on new methodologies at university level, new teaching approaches in the wake of the Covid-19 pandemic and the use of Wooclap in the classroom. Information on the courses and students analysed is then provided. After that, the methodology of the study and the questionnaire conducted are described. Thirdly, the main results of the analysis are presented through basic statistics and Pearson's Chi-square test, as well as some qualitative results through an open-ended question. Finally, the main conclusions and recommendations are detailed.

LITERATURE REVIEW

New learning methodologies in higher education

In the realm of higher education, pedagogical approaches are constantly evolving to adapt to the changing needs of students and the demands of society. In this context, active learning methodologies have gained popularity as an effective approach to improve the quality of university education (Espejo Leupin, 2016), as well as Student Response Systems (Tuttle, 2021).

Active methodologies are conceived as methods, techniques, and strategies that lecturers use to transform the teaching process into activities that encourage active student participation and lead to learning (Labrador & Andreu, 2008). Their use in university teaching has a significant impact on concepts such as teaching quality and academic outcomes (Palazón-Pérez de los Cobos et al., 2011) and enables the acquisition of skills for academic and professional performance (Robledo et al., 2015). Regardless of the typology of active methodologies used, they all show a positive impact on university students. For example, the literature has studied their positive effects on problem-based learning (PBL), where students acquire greater personal competencies and teamwork skills (Rézio et al., 2022); in project-based learning (PjBL), highlighting improved motivation and performance (Kondo et al., 2023); in flipped classrooms, enhancing learning and problem-solving skills (McLaughlin et al., 2014); in Game-Based Learning in terms of improved final grades compared to a control group (Molina-Torres et al., 2021), or in collaborative learning, in aspects such as improved digital skills management (Micaletto-Belda & Martín-Herrera, 2023).

In the case of Student Response Systems (SRS), their use improves aspects such as student engagement, concentration and better feedback (Çelik & Baran, 2022). These are conceived as “*hardware/software devices that allow teachers to easily create interactive learning environments*” (Moreno-Medina et al., 2023). The main characteristics of SRS are interactivity, real-time feedback, anonymity and versatility (Bruf, 2009). Although these techniques have gained popularity in recent years and have developed in parallel with technological advances, even in their early manifestations they already showed effects such as changes in classroom dynamics or improved student attention (Nagy-Shadman & Desrochers, 2008; Stowell & Nelson, 2007). By applying SRS in university activity, positive effects have been perceived by students in the anonymity of results, which has encouraged greater participation (Ingalls, 2020); an improvement in performance linked to rapid feedback in the evaluation during the development of lessons (Cantero-Chinchilla et al., 2020) and, in particular, the literature shows positive effects on improving student motivation and participation in class (Altwijri et al., 2022; Shahba et al., 2023).

The implementation of these methodologies in the classroom requires a reconfiguration in the conception of the learning process, in the organization of courses, in the development of educational activities, and in the assessment of students' progress. Lecturers must make an effort to integrate all these aspects, not limiting themselves to incorporating isolated activities (Silva Quiroz & Castillo, 2017). From this perspective, and with the aim of encouraging faculty members to adapt globally to the contexts demanded by active learning methodologies and SRS, universities are committed to funding projects dedicated to improving the quality of university teaching. In the case of the University of Valencia, the goal is to “*Promote reflection on ICT as a tool in the service of innovative methodologies and contribute to digital and ecological transition*” (Universitat de València, 2023) through educational innovation programmes, and training in active methodologies is organised through its Permanent Training and Educational Innovation Service (SPFIE).

New teaching approaches after the Covid-19 pandemic

Recent academic literature agrees that the sudden adaptation of teaching to the digital realm, as a result of COVID-19, forced both students and lecturers to learn about the functioning of the digital learning environment and online tools (Dhawan, 2020). The sudden social distancing distance forced a rapid adaptation and development of new teaching methods that could ensure the continuity of learning (Hodges et al., 2020). Faced with this disruptive fact, technology has been responsible for significantly changing the way we interact, communicate, study and research (Pescador Vargas, 2014).

Focusing on higher education, there have been several challenges to overcome. From the point of view of the lecturers, the first has been the rapid adaptation to virtual teaching, through the use of online learning applications, but more importantly, it has been the acquisition of the necessary skills for it. The use of these tools has made it possible to make educational programmes more flexible and more accessible, regardless of geographical location (UNESCO, 2020a). Thus, gamification, among other tools, has become more relevant in the field of education (Pelegrín-Borondo et al., 2021).

A second challenge, this time for students, has been the greater degree of responsibility assumed by students, both in learning and in managing their time and study goals. This greater autonomy, imposed by the situation, has promoted some of the soft skills needed in the professional world, such as self-learning and self-regulation (Hodges et al., 2020).

Prior to the pandemic, there was already evidence that the application of technological tools increases the added value of education, providing both professors and students with new possibilities of evaluating and dynamising teaching (Molinero Bárcenas & Chávez Morales, 2019). These have revolutionised the way in which instructors and students obtain, manage and interpret information, thus improving the quality of teaching (Aguilar, 2012). Following COVID-19, and with the need to collaborate and communicate online, collaboration between students has been

encouraged, through online work, discussions, forums and virtual chats. Both practices have fostered new value-added, collaborative learning, and have helped to diminish the sense of isolation that some students may have experienced during the pandemic (UNESCO, 2020b).

Another approach has been the increased personalisation of learning. Educators and lecturers have adapted and provided customised resources for individual needs that they may not have been aware of prior to COVID-19 (Darling-Hammond et al., 2017). In this regard, mental health and social-emotional needs have become more prominent, including in the classroom (Darling-Hammond et al., 2017). Overall, these changes have led to innovation and a re-evaluation of traditional pedagogical practices (Pelegrín-Borondo et al., 2021).

The use of Wooclap in classroom

The set of changes mentioned above has led to the need to develop and implement new tools in the classroom. In this sense, in recent years, and even more so after the Covid-19 pandemic, the use of Student Response Systems (SRS) (Herrada et al., 2020) such as Kahoot, Plickers, Quizziz or Wooclap has increased in the classroom and has also boosted the students' engagement (Moreno-Medina et al., 2023).

Wooclap is an online participation platform designed to engage audiences during presentations, lectures or live events. The application is used via an electronic device and provides the possibility to ask a variety of questions, including multiple choice, poll, matching fill-in-the-blank or brainstorming, among others (Grzych & Schraen-Maschke, 2019), which speakers can insert into their presentations and receive an interactive response from the students. Its academic use is widespread as it is used by more than 500,000 professors in more than 400 universities in 150 countries (Wooclap, 2023).

In the field of higher education, the platform has been used in different disciplines, such as engineering (Aldalur & Perez, 2023; Moreno-Medina et al., 2023); geography (Braçe-Diko & Garrido-Cumbrera, 2022); journalism (Catalina-García & García-Galera, 2022), medicine (Grzych & Schraen-Maschke, 2019); biology (Marin et al., 2021); computer science (Rodríguez Calzada, 2021); languages (Boostani et al., 2020) and pharmacology and immunology (Sanz et al., 2020). All of them have experienced positive results in the classroom after their use, confirming the transversality of the application.

The literature has also studied the benefits of using Wooclap in the classroom, such as improving the learning process based on motivation and improved attention (Aldalur & Perez, 2023; Moreno-Medina et al., 2023), the interaction and communication between lecturers and students (Braçe-Diko & Garrido-Cumbrera, 2022), the introduction of debate and collective reflection (Catalina-García & García-Galera, 2022) and the involvement of students (Rodríguez Jiménez et al., 2019). Furthermore, and after comparing Wooclap with other interactive response platforms, it has been shown that two of the strengths of the application are in the process of learning and understanding, as well as student participation at any time during the class (Grzych & Schraen-Maschke, 2019).

The different platform assessment studies show results applied in single courses (Aldalur & Perez, 2023; Grzych & Schraen-Maschke, 2019; Rodríguez Calzada, 2021) in the same course in different degrees (Braçe-Diko & Garrido-Cumbrera, 2022) or in different courses in the same degree (Catalina-García & García-Galera, 2022), but no literature has been found comparing three different courses in the field of economics in three different degrees.

METHODOLOGY

This research compares the experience of using the Wooclap platform in three courses in the field of Economics at the University of Valencia, with different teaching objectives and dynamics. Through a heterogeneous sample of three classes, the aim is to find out whether the results of

introducing an interactive response tool are homogeneous in university teaching, or whether there are differences between courses. Moreover, the implementation of this tool by three different researchers involves an investigator triangulation exercise in order to reduce potential biases in the application and observation of the results (Kimchi et al., 1991).

In the three courses, the implementation of the Wooclap platform was carried out by interspersing questions of different typologies throughout the contents presented in the theory classes. According to previous experiences with the use of audience response tools in higher education, it was used exclusively for didactic purposes, with no consequences on student assessment (Hussain & Wilby, 2019; Wood & Shirazi, 2020).

Courses' description

Introduction to Taxation (IT) is taught in the second year of the Bachelor's degree of Business Administration and Management (GADE), second semester. This course is common to the double degrees of Tourism and Business Administration and Management and Law and Business Administration and Management, but in the double degrees it is taught in the third year. The main objectives of the course are to train professionals in management, consultancy, and evaluation in companies; to familiarise students with the environment and language of taxation; to provide the knowledge to analyse the impact of tax regulations on business decisions; and to offer the necessary experience to settle income tax and use the resources of the Tax Agency.

Introduction to Economic Policy (IEP) is taught in the Bachelor's degree in Economics (GECO) during the second year of the second semester. It aims to provide students with an analytical framework for the study of public policies affecting the economic sphere, with an emphasis on governance, the different levels of government, and the objectives and instruments used to achieve them. It is important to note that the group analysed is considered High Academic Performance (ARA), and that 30% of the students are international.

Finally, Economics Applied to Social Sciences (EASS) is a basic training course taught in the second semester of the first year of the Bachelor's Degree of Social Work. Unlike the previous two, it is not taught to Economics and Business students. It is an introductory course, and the only economics course students take throughout their degree. The course studies the basic principles of Western society economics. It analyses the functions and failures of the market and the State, studies the behaviour of private and public economic agents, and the economy as a whole. From these basic elements, a series of practical and conceptual tools are explored to provide an initial approach to current economic problems. Table 1 shows the main characteristics of the three courses.

Table 1. Overview of the courses

Course	Introduction to Taxation (IT)	Introduction to economic policy (IEP)	Economics applied to Social Sciences (EASS)
Degree	Business Administration and Management	Economics	Social Work
Course and semester	2 nd course 2 nd semester	2 nd course 2 nd semester	1 st course 2 nd semester
ECTS Credit and typology	6. Compulsory	6. Compulsory	6. Basic
Language	Spanish	English	Catalan
Campus	Ontinyent Campus, University of Valencia	Tarongers Campus, University of Valencia	Tarongers Campus, University of Valencia

Questionnaire design

The methodology employed for gathering information involved conducting surveys with students through a common questionnaire as the primary instrument. This is a data collection tool that formally organises questions designed to extract the required information (Dillon et al., 1994). Questionnaires allow for the economical and rapid collection of data (Charlton, 2000) and are usually easy to administer (Rahman et al., 2010).

The questionnaire, entitled “Survey on the use of the Wooclap platform in the course during the academic year 2022-2023,” is structured in a block entitled “Introduction of interactive questions in theory classes”; and a final open-ended question. The block consists of different questions with responses oriented towards to a Likert scale (Matas, 2018). The scale consists of 5 response options, where the rating ‘1’ represents ‘Strongly disagree’ and the rating ‘5’ represents ‘Strongly agree’. The choice of the 5-point scale is due to its ability to provide a sufficient range of options to capture students’ sensitivity to the questions posed. The survey items include aspects such as the contribution of the interactive questions to maintain attention, to consolidate and better understand concepts, to identify the most important contents or to increase class attendance. Students are also asked about the adequacy of the number of questions, ending with an overall assessment of the platform, and whether they would recommend extending its use in future years and to other courses and lecturers. Finally, students are asked a final open-ended qualitative question to provide an overall assessment of the functionality of the platform. This question allows for a greater depth and variety of responses from respondents, enriching the research (Patton, 2014). The questionnaire can be found in Appendix.

The data collection period took place in May 2022, at the end of the course. The 9 formulated questions were answered by a total of 97 students, with each sample having a confidence level of 95% and a margin of error between 7%-9%. This margin of error is considered acceptable given the small population size (Lohr, 2021).

Table 2 shows the main characteristics of the conducted study.

Table 2. Survey factsheet

	Introduction to Taxation	Introduction to Economic Policy	Economics applied to Social Sciences
Response date	05/10/2023	05/19/2023	05/17/2023
No. of questions	9		
Type of questions	Likert and open-ended response items		
No. of students	35	38	47
No. of responses collected	28	30	39
Confidence and error margins	95% / 9%	95% / 9%	95% / 7%

Profile of surveyed students

Just as the three courses differ significantly in terms of objectives, methodology, and evaluation, the profile of students in each field has distinctive characteristics. Students of Applied Economics to Social Sciences are mainly characterised by being a feminised group (9 out of 10 are women) and by being students in a discipline outside of economics and business. In contrast, students in Introduction to Taxation stand out as a class where about 15% of students are repeating the course and as the only group where transfers from another Faculty or Campus have been requested. Finally, students in Introduction to Economic Policy differ because more than 30% come from international programs and because there is a high proportion of students who only study and do not work. Table 3 provides a more detailed overview of the different academic profiles.

To test whether there are significant differences in the response to different survey questions among the groups of different courses, the Pearson chi-square test is applied (Greenwood & Nikulin, 1996). We use this test because it involves testing differences in distribution by crossing two categorical variables: the course (with three categories) and each of the items (ordinal variables with five levels).

Table 3. Student characteristics

Characteristics/Courses		Introduction to Taxation	Introduction to economic policy	Economics applied to Social Sciences
Gender	Men	51.4%	55.3%	10.6%
	Women	48.6%	44.7%	89.4%
Age	Avg.	21.22	20.6	19.7
Access to university studies	Post-secondary non-tertiary education	14.2%	0%	23.5%
	University access tests	77.3%	68.4%	76.5%
	Transfer	8.5%	0%	0%
	International Studies	0%	31.6%	0%
Occupation	No	88.57%	84.2%	78.8%
	Occasional work	11.43%	15.8%	17%
	Part-time work	0%	0%	4.2%
1 st enrolment		85.7%	97.4%	100%
Other studies	No	74.30%	57.9%	65.9%
	Short-cycle tertiary education	2.85%	26.3%	0%
	Intermediate	22.85%	15.8%	34.1%

RESULTS

The main results of the survey are summarised in Table 4. As can be seen, the evaluations of the different items are positive. Most of the mean scores are between 4 and 5 on a scale of 1 to 5, both in the overall sample and for each of the three groups. General ratings and the recommendation to continue with this methodology and extend it to other lecturers and courses are particularly high, confirming the overall satisfaction of the students with this tool.

Regarding the fifth question, *'I think that the number of questions has been...'*, it should be noted that the average is around 3 because, in this case, the central value means *'adequate'*, as opposed to *'very few'* (1) and *'very excessive'* (5) at each of the extremes. This result is therefore also positive. In general, around 5-7 questions were asked per 90-minute theory session.

The lowest score across all groups and the whole sample corresponds to the effect of Wooclap on class attendance. However, it is also the question with the highest standard deviation, indicating that the responses to this question were very heterogeneous.

In any case, among who have attended classes, the majority agree that the introduction of interactive questions in theory classes has helped them to maintain attention, identify the most important concepts, and better understand and consolidate them.

Table 4. Survey results on the introduction of interactive questions

Question	Introduction to Economic Policy (N = 30)		Introduction to taxation (N = 28)		Economics applied to Social Sciences (N = 39)		Total (N = 97)	
	Avg.	S.D.	Avg.	S.D.	Avg.	S.D.	Avg.	S.D.
It has helped me to maintain attention in class.	4,27	0,64	4,50	0,58	4,18	0,82	4,30	0,71
It has helped me to consolidate and better understand the concepts.	4,07	0,94	4,39	0,63	4,18	0,85	4,21	0,83
It has helped me to identify the most important concepts of each topic.	4,03	0,81	4,39	0,69	4,08	0,98	4,15	0,86
It has made me attend the theory classes more frequently.	3,87	0,94	4,29	0,76	3,49	1,30	3,84	1,10
I think that the number of questions has been...	3,20	0,71	3,14	0,59	2,95	0,46	3,08	0,59
Overall, I rate it positively.	4,37	0,72	4,61	0,57	4,56	0,60	4,52	0,63
I would recommend continuing this in future courses of the course.	4,30	0,79	4,79	0,42	4,62	0,71	4,57	0,69
I would recommend lecturers of other courses to introduce it.	4,13	0,90	4,86	0,36	4,41	0,99	4,45	0,87

Note: All questions are answered on a scale of 1 to 5, where 1 means 'Strongly disagree' and 5 means 'Strongly agree', except for the fifth question where 3 means 'Adequate', 1 means 'Insufficient' and 5 means 'Excessive'.

Although some minor differences can be observed between the groups of different courses (e.g. Introduction to Taxation students have higher mean scores on many questions), the Pearson chi-square test (Greenwood & Nikulin, 1996) must be applied to determine whether these differences are statistically significant and not just the result of random error. The null hypothesis to be tested in each case is that there is no relationship between the group or course affiliation and the different assessments of the teaching methodology. The results are summarised in Table 5.

Since in no case is the p-value less than 0.05, the null hypothesis cannot be rejected with 95% confidence. This means that there are no significant differences between the three groups, so it cannot be stated that the group to which the students belong (and, therefore, their particular experience) is the determining factor in the evaluation of the teaching methodology. In other words, the evaluation of Woodclap is independent of the course studied, or at least, the difference is not statistically significant at 95%.

Additionally, it is observed that the questions least dependent on the group (i.e., with smaller differences between the groups) are the overall assessment, as well as the identification and consolidation of concepts.

Table 5. Pearson's Chi-square tests contrasting the independence of responses according to the course taken.

Question	χ^2	Degrees of freedom	p-value
It has helped me to maintain attention in class.	9,152	4	0,057
It has helped me to consolidate and better understand the concepts.	5,290	6	0,507
It has helped me to identify the most important concepts of each topic.	6,728	8	0,566
It has made me attend the theory classes more frequently.	15,064	8	0,058
I think that the number of questions has been...	8,448	6	0,207
Overall, I rate it positively.	2,991	4	0,559
I would recommend continuing this in future courses of the course.	9,065	6	0,170
I would recommend lecturers of other courses to introduce it.	15,181	8	0,056

In addition to the 1–5-point questions, the survey also included an optional open-ended question where respondents could add any comments they considered relevant.

In this question, the students highlighted the dynamism provided by Wooclap to make the lessons more enjoyable and entertaining. For example, “it is a great tool for making the course more dynamic and learning in a different way” (S39. EASS), “I really liked it, the theory was more entertaining and dynamic” (S26. IT) or “the course was more dynamic, not being all theory” (S19. IT). Other students linked this issue of dynamism to the understanding of the concepts (e.g., “it has been a dynamic and fun way to learn concepts that were previously difficult to understand” –S11. EASS– or “Wooclap is a different dynamic that makes students deepen their knowledge and understand it better” –S21. EASS–), especially if the students perceive the content of the course as hard and dense: “I think it makes the class more alternative, even if it is a dense course with a lot of syllabus, the platform can help to a better understanding and give more dynamism so that the classes do not become too heavy” (S26. EASS), “this mechanics makes the lessons less conventional and heavy, as they are more enjoyable and make a course that could be a bit more demanding to learn, more bearable” (S38. EASS).

Another aspect that was not directly asked about in the survey and that emerged in the open response is the fact that it facilitates interaction between lecturer and students, with statements such as “it makes much easier the exchange of ideas in class” (S21. IEP), and those who simply underline “the interaction with the student” (S6. IT) or “the possibility of interacting” (S14. IT).

Perhaps as a result of the previous two aspects, dynamism and interaction, there are several students who point out that Wooclap helped them to keep their attention in class. For instance, “it is a very good application to keep attention in class” (S5. EASS), “Wooclap makes you keep your attention in class” (S21. IT) or “very efficient to capture the attention of students so that the class is not so monotonous” (S22. IT).

However, it should not be forgotten that the ultimate aim of the tool, beyond making the classes enjoyable and entertaining, is that they fulfil their function and that a series of knowledge and competences are successfully achieved by the students. In this sense, there are also numerous comments that indicate that the application has contributed satisfactorily to this objective. For example, “I found it very useful to use this platform to better integrate the concepts of the courses in an easier and more effective way (...) Thanks to this way of conducting the classes I have been able to understand this course better” (S38. EASS), “it is very useful to reach the knowledge and, especially, to see what is most important in each topic” (S5. EASS), “the idea of using Wooclap in

theory classes is good because it helps students to be attentive and to understand the contents of the course in an interactive way” (S17. IT) or simply “useful for revision” (S5. IT).

DISCUSSION AND CONCLUSION

This paper analyses the implication on students of the introduction of an SRS in university teaching, in the context of new university learning methodologies. We focus on the effects on classroom attention, assimilation and identification of the most relevant content, and class attendance. In other research, literature shows the positive effect of this type of application in different subject areas (Catalina-García & García-Galera, 2022; Aldalur & Perez, 2023) and the positive effect in aspects such as student participation and motivation in class (Ingalls, 2020).

The results of our study are in line with the previous literature and reveal the same positive results. However, no comparative study has been carried out between courses with different profiles in the field of economics.

In this paper, as a novelty in the literature, we compare the responses of students in three different courses: Introduction to Economic Policy, from the Bachelor's degree in Economics; Introduction to Taxation, from the Bachelor's degree in Business Administration and Management; and Economics applied to Social Sciences, from the Bachelor's degree in Social Work.

In response to the second research question, the results show, with statistical support, that there are no significant differences between the responses of the groups analysed. Despite the heterogeneity of the student profile, the students' assessment is very positive in all courses, which makes it advisable to continue using the application, and even to extend it to other courses and lecturers. We confirm the theoretical evidence that SRS tools, in which Wooclap stands out, are effective in maintaining attention in class and identifying, consolidating and retaining the most important concepts of each course. They enhance teacher-student communication and, to a lesser extent, encourage class attendance. Likewise, and answering the first research question, it is highlighted that, in addition to all its positive effects, the main added value of the platform lies in its heterogeneity and versatility to adapt to the contents of a wide range of academic disciplines. This paper provides scientific evidence in the economic field.

In line with the many benefits of this SRS in the university environment, it is recommended that the use of this platform and SRS systems be extended and promoted by educational institutions.

On the other hand, from the lecturer's perspective, Wooclap makes it possible to break the monotony of a theoretical lesson, enlivening explanations and redirecting the student's attention to the classroom, elements of change that other research has considered positive. It also provides instant feedback on the level of comprehension of concepts, ideas and processes, and allows the instructor to go back and highlight those issues that have not been properly understood. All of this is achieved without the need to overuse the application; between 5 and 7 questions per session are sufficient.

The comparative study provides new empirical evidence and allows replication and extension of the application to other courses, promoting the use of Wooclap and its positive results in university teaching. Nevertheless, despite the novelty of the study and its satisfactory results, we cannot provide certainty about the effect on students' final grades and on the attainment of knowledge and competencies. Future research could attempt to address this issue by including randomly selected control groups to obtain causal evidence. This is not the only limitation of this research. Although the courses have varied characteristics, they are confined to the economic field. In order to test whether this tool can be equally applicable to other fields, and whether there are significant differences, future research should extend its use to other disciplines. Finally, although

the potential of Wooclap from the lecturers' side has been observed by the authors' own teaching participation, when extending its use to more courses in future research, a focus group with the participating lecturers will be carried out for a better evaluation.

REFERENCES

- Aguilar, M. (2012). Aprendizaje y Tecnologías de Información y Comunicación: Hacia nuevos escenarios educativos. *Revista Latinoamericana De Ciencias Sociales, Niñez Y Juventud*, 10(2), 801–811.
- Aldalur, I., & Perez, A. (2023). Gamification and discovery learning: Motivating and involving students in the learning process. *Heliyon*, 9(1), e13135. <https://doi.org/10.1016/j.heliyon.2023.e13135>
- Altwijri, O., Alsadoon, E., Shahba, A. A. W., Soufan, W., & Alkathiri, S. (2022). The Effect of Using “Student Response Systems (SRS)” on Faculty Performance and Student Interaction in the Classroom. *Sustainability*, 14(22), 14957. <https://doi.org/10.3390/su142214957>
- Boostani, N., Brumelot, C., Ouvrard, L., Stockinger, P., Vigny, P.-J., Tice-Dsirn, U., & Ho, C. (2020). L'enseignement-apprentissage du lexique médiatisé par le smartphone en classe de langue (le cas de la plateforme Wooclap). In *Archives Audovosuelles Inalco*. <https://hal.science/hal-03161986>
- Braçe-Diko, O., & Garrido-Cumbrera, M. (2022). Utilización de herramientas tecnológicas de dinamización docente en educación superior de asignaturas de geografía. *Geosaberes: Revista de Estudios Geoeducacionais*, 13(1), 178–185. <https://doi.org/10.26895/geosaberes.v13i0.1315>
- Bruf, D. (2009) Teaching with Classroom Response Systems: Creating Active Learning Environments. Jossey-Bass. ISBN: 978-0-470-28893-1.
- Cantero-Chinchilla, F. N., Díaz-Martín, C., García-Marín, A. P., & Estévez, J. (2020). Innovative Student Response System Methodologies for Civil Engineering Practical Lectures. *Technology, Knowledge and Learning*, 25(4), 835–852. <https://doi.org/10.1007/s10758-019-09410-z>
- Catalina-García, B., & García-Galera, M. del C. (2022). Innovation and hi-tech tools in journalism education. The Wooclap case. *Doxa Comunicación. Revista Interdisciplinar De Estudios De Comunicación Y Ciencias Sociales*, 34, 19–32. <https://doi.org/10.31921/doxacom.n34a1141>
- Çelik, S., & Baran, E. (2022). Student response system: its impact on EFL students' vocabulary achievement. *Technology, Pedagogy and Education*, 31(2), 141–158. <https://doi.org/10.1080/1475939X.2021.1986125>
- Charlton, R. (2000). Research: Is an “Ideal” Questionnaire Possible? *International Journal of Clinical Practice*, 54(6), 356–359. <https://doi.org/10.1111/j.1742-1241.2000.tb11922.x>
- Darling-Hammond, L., Hyster, M. E., & Gardner, M. (2017). *Effective Teacher Professional Development*. Learning Policy Institute.
- Dhawan, S. (2020). Online Learning: A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology Systems*, 49(1), 5–22. <https://doi.org/10.1177/0047239520934018>
- Dillon, W. R., Madden, T. J., & Firtle, N. H. (1994). *Marketing Research in a Marketing Environment*. Burr Ridge, Irwin.
- Espejo Leupín, R. M. (2016). ¿Pedagogía activa o métodos activos? El caso del aprendizaje activo en la universidad. *Revista Digital de Investigación En Docencia Universitaria*, 10(1), 16–27. <https://doi.org/10.19083/ridu.10.456>
- Greenwood, P. E., & Nikulin, M. S. (1996). *A Guide to Chi-Squared Testing*. John Wiley & Sons, Ltd.
- Grzych, G., & Schraen-Maschke, S. (2019). Interactive pedagogic tools: Evaluation of three assessment systems in medical education. *Annales de Biologie Clinique*, 77(4), 429–435. <https://doi.org/10.1684/abc.2019.1464>

-
- Herrada, R. I., Baños, R., & Alcayde, A. (2020). Student response systems: A multidisciplinary analysis using visual analytics. *Education Sciences*, 10(12), 348. <https://doi.org/10.3390/educsci10120348>
- Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., & Bond, M. A. (2020). The difference between emergency remote teaching and online learning. In *Educause Review*. <http://hdl.handle.net/10919/104648>
- Hussain, F. N., & Wilby, K. J. (2019). A systematic review of audience response systems in pharmacy education. *Currents in Pharmacy Teaching and Learning*, 11(11), 1196–1204. <https://doi.org/10.1016/j.cptl.2019.07.004>
- Ingalls, V. (2020). Students Vote: A Comparative Study of Student Perceptions of Three Popular Web-Based Student Response Systems. *Technology, Knowledge and Learning*, 25(3), 557–567. <https://doi.org/10.1007/s10758-018-9365-0>
- Kimchi, J., Polivka, B., & Stevenson, J. S. (1991). Triangulation: Operational Definitions. *Nursing Research*, 40(6), 364–366.
- Kondo, A., Hayashi, H., & Toyoshi, T. (2023). Project-Based Learning of Mechanical Design Utilizing CAE Structural Analyses. *Education Sciences*, 13(7), 687. <https://doi.org/10.3390/educsci13070687>
- Kumar, R. M., & Kumar, R. K. (2010). Impact of E-Learning on Teacher Effectiveness. *Journal of Educational Technology*, 7(3), 63–68.
- Labrador, M. J., & Andreu, M. Á. (2008). *Metodologías activas*. Universitat Politècnica de València.
- Lohr, S. L. (2021). *Sampling. Design and Analysis* (Third edit). CRC Press.
- Marin, J., Brichler, S., Lecuyer, H., Carbonnelle, E., & Lescat, M. (2021). Feedback From Medical and Biology Students on Distance Learning: Focus on a Useful Interactive Software, Wooclap®. *Journal of Educational Technology Systems*, 50(2), 188–200. <https://doi.org/10.1177/00472395211023383>
- Matas, A. (2018). Diseño del formato de escalas tipo Likert: Un estado de la cuestión. *REDIE: Revista Electrónica de Investigación Educativa*, 20(1), 38–47. <https://doi.org/10.24320/redie.2018.20.1.1347>
- McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., Esserman, D. A., & Mumper, R. J. (2014). The flipped classroom: A course redesign to foster learning and engagement in a health professions school. *Academic Medicine*, 89(2), 236–243. <https://doi.org/10.1097/ACM.0000000000000086>
- Micaletto-Belda, J. P., & Martín-Herrera, I. (2023). Aprendizaje colaborativo en la Universidad: análisis de una experiencia con una comunidad virtual en LinkedIn. *EDMETIC*, 12(1), 4–20. <https://doi.org/10.21071/edmetic.v12i1.14344>
- Molina-Torres, G., Rodríguez-Arrastia, M., Alarcón, R., Sánchez-Labraca, N., Sánchez-Joya, M., Roman, P., & Requena, M. (2021). Game-based learning outcomes among physiotherapy students: Comparative study. *JMIR Serious Games*, 9(1), e26007. <https://doi.org/10.2196/26007>
- Molinero Bárcenas, M. del C., & Chávez Morales, U. (2019). Herramientas tecnológicas en el proceso de enseñanza-aprendizaje en estudiantes de educación superior. *RIDE Revista Iberoamericana Para La Investigación y El Desarrollo Educativo*, 10(19), e005. <https://doi.org/10.23913/ride.v10i19.494>
- Moreno-Medina, I., Peñas-Garzón, M., Belver, C., & Bedia, J. (2023). Wooclap for improving student achievement and motivation in the Chemical Engineering Degree. *Education for Chemical Engineers*, 45, 11–18. <https://doi.org/10.1016/j.ece.2023.07.003>
- Nagy-Shadman, E., & Desrochers, C. (2008). Student response technology: Empirically grounded or just a gimmick? *International Journal of Science Education*, 30(15), 2023–2066. <https://doi.org/10.1080/09500690701627253>
-

-
- Palazón-Pérez de los Cobos, A., Gómez-Gallego, M., Gómez-Gallego, J. C., Pérez-Cárceles, M. C., & Gómez-García, J. (2011). Relationship Among Application of Active Teaching Methodologies and Learning of University Student. *Bordon-Revista de Pedagogía*, 63(2), 27–40.
- Patton, M. Q. (2014). *Qualitative Research and Evaluation Methods: Integrating Theory and Practice* (4th ed.). Sage Publications.
- Pelegrín-Borondo, J., Sierra-Murillo, Y., García-Milon, A., & Olarte-Pascual, C. (2021). Game of Thrones in Class (Episode 2). ¿Improving Gamification reduces Amotivation and Increases Service Quality in Class? *Journal of Management and Business Education*, 4(2), 165–182. <https://doi.org/10.35564/jmbe.2021.0010>
- Pescador Vargas, B. (2014). ¿Hacia una sociedad del conocimiento? *Revista Med*, 22(2), 6–7. <https://doi.org/10.18359/rmed.1194>
- Rahman, M. S., Usman, S., Warren, O., & Athanasiou, T. (2010). Questionnaires, Surveys, Scales in Surgical Research: Concepts and Methodology. In T. Athanasiou, H. Debas, & A. Darzi (Eds.), *Key Topics in Surgical Research and Methodology* (pp. 477–494). Springer. https://doi.org/10.1007/978-3-540-71915-1_36
- Rézio, S., Pedro Andrade, M., & Filomena, M. F. (2022). Problem-Based Learning and Applied Mathematics. *Mathematics*, 10(16), 2862. <https://doi.org/10.3390/math10162862>
- Robledo, P., Fidalgo, R., Arias, O., & Álvarez, M. L. (2015). Percepción de los estudiantes sobre el desarrollo de competencias a través de diferentes metodologías activas. *Revista de Investigación Educativa*, 33(2), 369–383. <https://doi.org/10.6018/rie.33.2.201381>
- Rodríguez Calzada, L. (2021). Learning New Innovative Methodologies Used in COVID-19 Times. *Journal of Management and Business Education*, 4(3), 338–353. <https://doi.org/10.35564/jmbe.2021.0018>
- Rodríguez Jiménez, C., Ramos Navas-Parejo, M., Santos Villalba, M. J., & Fernández Campoy, J. M. (2019). El uso de la gamificación para el fomento de la educación inclusiva. *International Journal of New Education*, 3, 39–59. <https://doi.org/10.24310/ijne2.1.2019.6557>
- Sanz, E. J., Vicente-Romero, J., & Prieto, A. (2020). Experiencias de Docencia Virtual en Facultades de Medicina Españolas durante la pandemia COVID-19 (II): Farmacología, Inmunología. *Revista Española de Educación Médica*, 1(1), 74–81. <https://doi.org/10.6018/edumed.429481>
- Shahba, A. A. W., Soufan, W., Altwijri, O., Alsadoon, E., & Alkathiri, S. (2023). The Impact of Student Response Systems (SRS) on Student Achievements: A University-Scale Study with Deep Exploratory Data Analysis (EDA). *Systems*, 11(8), 384. <https://doi.org/10.3390/systems11080384>
- Silva Quiroz, J., & Castillo, D. M. (2017). A proposal of a Model for the introduction of active methodologies in Higher Education. *Innovación Educativa*, 17(73), 115–131.
- Stowell, J. R., & Nelson, J. M. (2007). Benefits of electronic audience response systems on student participation, learning, and emotion. *Teaching of Psychology*, 34(4), 253–258. <https://doi.org/10.1080/00986280701700391>
- Tuttle, G. (2021). *Effects of Student Response System in University Foundation Courses*. Idaho State University.
- UNESCO. (2020a). *Beyond Disruption: Technology Enabled Learning Futures*.
- UNESCO. (2020b). *Ensuring effective distance learning during COVID-19 disruption: guidance for teachers*. <https://doi.org/10.54675/HKXT1562>
- Universitat de València. (2023). *Permanent Training and Educational Innovation Service (SFPIE)*. <https://www.uv.es/uvweb/lifelong-learning-service-educational-innovation/en/educational-innovation/innovation-projects/innovation-projects-1285879014680.html>
- Wooclap. (2023). *Wooclap*. <https://www.wooclap.com/>
-

-
- Wood, R., & Shirazi, S. (2020). A systematic review of audience response systems for teaching and learning in higher education: The student experience. *Computers & Education*, 153, 103896. <https://doi.org/10.1016/j.compedu.2020.103896>
- Zdravkovska, N., Cech, M., Beygo, P., & Kackley, B. (2010). Laser Pointers: Low-cost, Low-tech Innovative, Interactive Instruction Tool. *The Journal of Academic Librarianship*, 36(5), 440–444. <https://doi.org/10.1016/j.acalib.2010.06.008>

APPENDIX

SURVEY ON THE USE OF THE WOOC LAP PLATFORM IN THE COURSE DURING THE ACADEMIC YEAR 2022-2023

Please state your degree of agreement or disagreement with the following statements by clicking the corresponding number. The answers will be treated anonymously, will not be shared with third parties and will only be used for statistical, research and teaching improvement purposes.

INTRODUCING INTERACTIVE QUESTIONS IN THEORY CLASSES

1: The introduction of interactive questions in theory classes has helped me to maintain attention in class.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither agree nor disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5

2: The introduction of interactive questions in theory classes has helped me to consolidate and better understand the concepts.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither agree nor disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5

3: The introduction of interactive questions in theory classes has helped me to identify the most important concepts of each topic.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither agree nor disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5

4: The introduction of interactive questions in the theory classes has made me attend the theory classes more frequently.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither agree nor disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5

5: I think that the number of interactive questions in the theory classes has been....

<i>Very few</i>	<i>Few</i>	<i>Adequate</i>	<i>Excessive</i>	<i>Very excessive</i>
1	2	3	4	5

6: In general, I value positively the introduction of interactive questions in the theory classes.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither agree nor disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5

7: I would recommend continuing the introduction of interactive questions in theory classes in future editions of the course.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither agree nor disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5

8: I would recommend to introduce interactive questions in theory classes to other lecturers of other courses.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither agree nor disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5

OPEN ANSWER (OPTIONAL)

9: Please note any other aspect related to the use of the Wooclap platform (or other interactive platforms for teaching) that you would like to highlight.

DECLARATION OF CONFLICTING INTERESTS

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CREDIT AUTHOR STATEMENT

All authors have contributed equally to all parts of the work, so they are listed in alphabetical order.