An effective video-based learning approach: a solution for complex university subjects

Una propuesta efectiva de aprendizaje basado en videos: solución para asignaturas universitarias complejas

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ABSTRACT

This research presents a tool that offers an agile solution for university subjects perceived by students to be significantly complex. The tool combines, on the one hand, video-based learning and, on the other hand, a system for assessing difficulty prior to the production of videos. As a starting point, student feedback was used to obtain a map of subject difficulty. Based on the identifying markers on this map, a set of ad hoc videos was prepared to address the key and most difficult issues. After using these videos in their preparation in the subject, students completed a satisfaction survey, which was qualitatively validated by experts and quantitatively validated with a Cronbach's alpha test. The results of this survey reflect the usefulness of the designed learning proposal and the interest aroused in the students. Likewise, through statistical analysis, an improvement in the academic performance of students with access to these videos compared to the control group was revealed. Using an accounting subject for a pilot test has enabled the construction of a learning proposal that can be extrapolated to any field of knowledge. The proposed system thus contributes an effective teaching process for students and allows them to be protagonists in their own academic training.

Keywords: difficulty map; visual learning; accounting; feedback; higher education.

RESUMEN

Esta investigación presenta una herramienta que ofrece una ágil solución para aquellas asignaturas universitarias percibidas por los estudiantes con mayor complejidad. La herramienta combina, por un lado, el aprendizaje basado en videos y, por otro, un sistema de baremación de la dificultad, previo a la elaboración de los videos. Como punto de partida, se utiliza el feedback del estudiante para la obtención de un mapa de dificultad de la asignatura. A partir de las balizas identificativas de este mapa, se ha elaborado ad hoc un conjunto de videos para abordar las cuestiones clave y de mayor dificultad. Tras utilizar estos videos en la preparación de la materia, los estudiantes han realizado una encuesta de satisfacción, validada cualitativamente por expertos y cuantitativamente por el test Alpha de Cronbach. Los resultados de la encuesta reflejan la utilidad de la propuesta de aprendizaje diseñada y el interés despertado en los estudiantes. Asimismo, mediante un análisis estadístico, se pone de manifiesto una mejora en el rendimiento académico de aquellos que sí tuvieron acceso a estos videos, en comparación con el grupo de control. Utilizando como prueba piloto una asignatura de contabilidad, se ha conseguido llegar a una propuesta de aprendizaje que resulta extrapolable a cualquier ámbito de conocimiento. El sistema propuesto contribuye a un proceso de enseñanza eficaz para los estudiantes y les otorga el rol de protagonistas en su propia formación académica.

Palabras clave: mapa de dificultad; aprendizaje visual; contabilidad; retroalimentación; enseñanza superior.

INTRODUCTION

Initially, this educational research was inspired by continuous efforts to solve two problems in an effective way. On the one hand, difficulties to understand are inherent in accounting matters (Fogarty, 2020; Zhao, 2019); on the other hand, there is a considerable lack of time with regard to teaching all the content included in the teacher's guide for the subject of Financial Accounting II. However, using this subject as a pilot test, a learning proposal has been derived that can be extrapolated to any field of knowledge.

In a global context where virtuality is positioning itself as a necessary modality to achieve the goals of higher education, in terms of improving the coverage and quality of education that guarantee the continued presence and graduation of students (Segovia-García et al., 2022), the COVID-19 pandemic situation arose suddenly. This was undoubtedly the most exceptional scenario that society has had to face recently and led to the closure of academic institutions worldwide (Caurcel & Crisol, 2022), driving the university community to develop different strategies to adapt to this new situation (Cleland et al., 2020; Martín-Cuadrado et al., 2021).

Information technology-enabled learning became the heart of education during the COVID-19 crisis, and many teachers have expressed their desire for evidence-based best practice guides and examples in this area (Sangster et al., 2020). This has given rise to the essential need to remedy the difficulty raised by its presence in teaching, further reinforcing our need to develop material adjusted for this purpose through videos on more complex issues based on the feedback of the students, thus converting them into active collaborators in creating material concurrent with the circumstances of the moment.

Video has unique characteristics that make it an effective approach for improving learning outcomes and student satisfaction, given its flexibility and high motivational potential, enabling it to partially improve and replace traditional learning approaches (Yousef et al., 2014a).

Video-based learning has proven to be an effective teaching tool for teachers in the development of collaborative critical debates, public promotion of teaching practice, and theoretical research related to practical problems (Brame, 2016; Ljubojevic et al., 2014; Kay 2012; Sablić et al., 2021; Vedder-Weiss et al., 2019). Regarding the subject of accounting, Camacho-Miñano et al. (2016) find that multimedia resources are a motivating and valid didactic instrument for learning financial accounting.

Additionally, the "frequently asked questions" instrument is increasingly being used to reduce response times; these are lists of questions and answers that arise regularly, within a specific context and related to a certain topic (Villaseñor, 2014). Undoubtedly, they can become a useful methodological tool in the academic field to meet certain information needs. Hence, they were the germ of the idea that led to the present investigation of questions that are more complex for students and that are raised more frequently when approaching the subject.

Learning based on training videos appears recurrently in the literature (Sablić et al., 2021, Yousef et al., 2014b). However, we have not found any research that combines this teaching methodology with a previous system for assessing difficulty.

The purpose of this research does not lie solely in showing a video-based learning activity through customary training videos. This research aims to contribute to the literature showing the process that leads to the improvement in teaching practice in

higher education through the creation of a training asset prepared by teachers and based on student feedback. In relation to feedback, numerous authors analyze this central component of the learning process as a tool, which, more than a corrective instrument, should be understood as one capable of helping students classify their doubts, as well as a means for improving learning, that is, a way of measuring their knowledge, skills and understanding (Chugh et al., 2022; Evans, 2013; Nicol et al., 2014; Scott, 2014).

Currently, there is evidence of a change in the feedback representations focused on student transmission; students are increasingly positioning themselves as active actors in feedback processes (Winstone et al., 2022). This work focuses precisely on this direction; feedback received from students and directed to teachers to ensure they are aware of students' learning difficulties.

The objective of this experience is to reinforce the teaching-learning process in complex university subjects through collaboration between students and teachers, that is, to generate accessible material that can positively influence the motivation of students, thereby demonstrating the effectiveness of this multimedia resource while contrasting it with perceptions.

Based on this objective, the present study aims to test the following hypotheses:

H1: *Students positively value the usefulness of video-based learning and its contribution to their preparation in the subject.*
H2: *The use of the proposed video tool, based on a system of difficulty assessment, can improve the results of the students.*

The first hypothesis conditions the structure of the satisfaction survey to enable analysis of its results from the triple perspective of its usefulness in deepening the preparation of the material, its usefulness as a tool that complements the common material of the subject and, its usefulness as a process designed to be a teaching methodology.

The second hypothesis is evaluated by means of a statistical analysis of students' qualifications, that is, of the sample group with access to the videos and of the control group without such access.

METHODOLOGY

In this section, the entire process followed in the development of the project is explained including its phases, the students who participated and the tools used in its development.

Procedure

The subject that has been used as a pilot test, Financial Accounting II, in the degree of Business Administration and Management, suffers from two problems that need to be addressed. On the one hand, the subject has very broad content that requires a large number of hours of work in the classroom; on the other hand, the reiteration of very common doubts that students raise in individual tutorials is evident. The subject in question consists of five topics, each with a very important and practical function.

The project is developed in three stages, which are represented in Figure 1.

Figure 1
Stages of the project
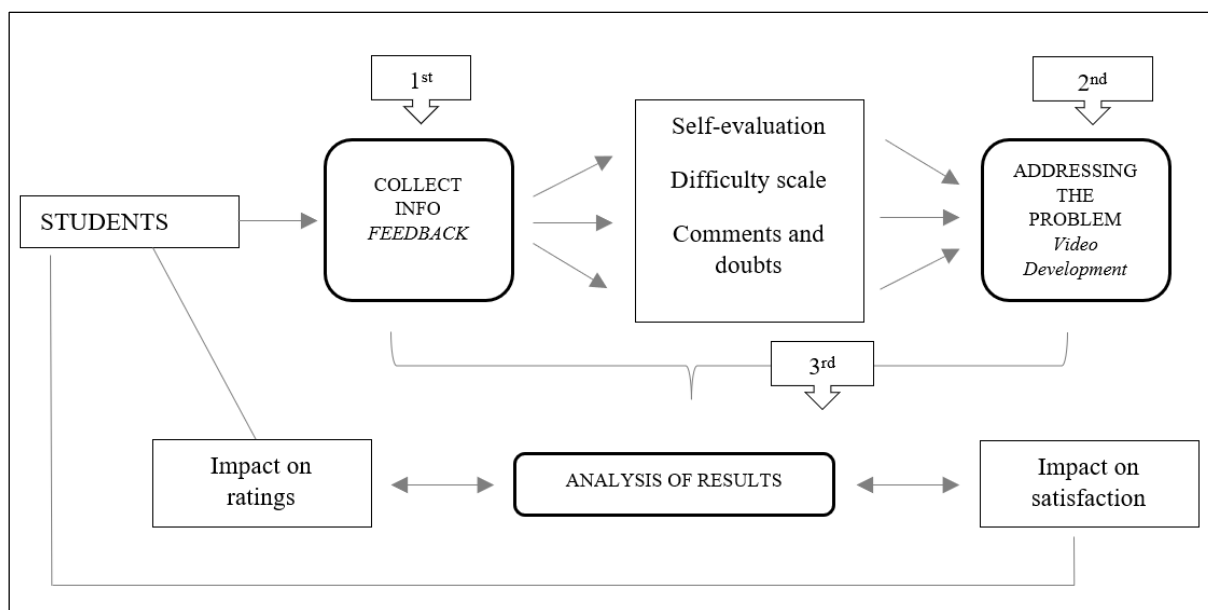
Source: Own elaboration.

The first stage is the stage of feedback. At the end of each of the topics, students were given a questionnaire to complete. As a result of this first phase, the difficulty map of the subject was obtained, providing identification beacons for the issues that entailed greater complexity for the students. In addition, this offered a reinforcement and improvement tool for the students, since it allowed them to check in which parts of each topic they had failed the most and thus had more questions to resolve.

In the second stage, the problem is addressed and the videos are made. This took place in the following academic year. In this course, these videos were used for the first time as support material for a group of students, a pilot group, with whom we were able to verify their usefulness. In addition, because the teaching modality was not totally face-to-face due to COVID-19, it was possible to reinforce these students' material in an interactive and dynamic way.

Finally, the third stage includes the analysis of results. This took place in the third class, which is the object of this study. New recordings were made for all the videos with a professional technical service, and these were made available to a wide group of students who studied the subject. These students completed a satisfaction survey that made it possible to evaluate the degree of usefulness of this project and its possible application in other subjects. In the present study, an analysis of the results achieved by the students was performed to compare the qualifications obtained in these groups and in others without these videos, which were considered to be the control groups.

Participants

The main idea is to involve students in each of the phases that make up the project. Having been carried out over three academic years, this study was able to differentiate four groups of students with different roles depending on the phase of the project.

1. *Group of students who participated in the phase of obtaining feedback* in the first year of the research. These students completed the questionnaire prepared at the end of each topic of the subject (collected in Section 2.3.1).
2. *Group of students who used the videos for the first time and provided a first evaluation of their usefulness* in the second class, which is the object of this research. This stage reinforced the idea of continuing the project with a greater scope in the next round.
3. *Groups of students who used the videos during the third round.* The videos were made available to a total of 210 students with three different teachers. One of them participated in the recording of the videos, and the other two did not. These students were given a satisfaction survey to evaluate the usefulness of the project.
4. *Groups of students used as control groups who learned the subject in the second class without access to the videos.* To determine whether the videos improve their results, the qualifications of the 230 students the three teachers taught without access to the videos are analyzed and compared with those of the 210 students with such access.

Instrument

This section explains the tools used in each of the phases of the project.

Preparation of questionnaires for obtaining student feedback

The starting point of the project is the development of a questionnaire to be completed by the students at the end of each topic. This system allowed us to collect the necessary information for the later elaboration of the videos. These questionnaires were parameterized through the free access *Socrative* platform, which allows interactions with students through different functionalities. They contain three clearly differentiated parts:

The first part contains a self-assessment system on the knowledge acquired on the topic (see Annex I, where an example for Topic 3 on financial instruments is shown).

In the second part, students indicate the degree of difficulty of the different questions addressed in the topic using a Likert scale from 1 to 5 (see Annex II, where an example for Topic 3 on financial instruments is shown).

Finally, a third party could openly express doubts and comments on the topic.

To check the reliability of the responses of the students, a Cronbach's alpha test was performed on the self-assessment questions and the scale of the degree of difficulty. Table 1 shows how for the questionnaires across all the topics a minimum result of 0.7 is reached. Acceptable values range between 0.70 and 0.95 (Bland & Altman, 1997; Hair et al., 2019; Reyes-Menéndez et al., 2019), which indicate a low dispersion in recorded responses and a certain homogeneity or trend.

Table 1
Cronbach's Alpha values of the quantifiable feedback questions

	Case Processing Summary			Reliability statistics	
Topic		**N**	**%**	**Cronbach's alpha**	**N of elements**
Topic 1	Valid cases	130	94.2	0.820	18
Topic 2	Valid cases	100	94.3	0.711	17
Topic 3	Valid cases	95	94.1	0.711	17
Topic 4	Valid cases	87	87.9	0.732	16
Topic 5	Valid cases	75	84.3	0.727	16

Source: Own elaboration.

Elaboration of the videos

The production of the videos took place in two phases. In the first phase, the teachers participating in the project recorded the videos by their own means through free access tools. This first recording was the one that was made available to students for the first time, in their second class, to obtain their first impression thereof. In the second phase, in order to make a professional recording of the videos, funding was obtained in the 1st Call for Teaching Innovation Projects of the Faculty of Legal and Social Sciences of the Rey Juan Carlos University.

These videos were posted on a YouTube channel to share their links with the students in a virtual classroom of the university. The videos can be viewed via the links in Table 2.

Table 2
Access links to videos on YouTube

TOPIC	LINK
TOPIC 1. Property, plant and equipment.	
TOPIC 1.1 The calculation of impairment	https://youtu.be/l3MGI953bPY
TOPIC 1.2 The recalculation of the amortization fee after impairment	https://youtu.be/SP32ENY50sY
TOPIC 1.3 Reversal of impairment and reversal limits	https://youtu.be/nfNWP0X-3z4
TOPIC 2. Intangible assets.	
TOPIC 2.1 Final result of the expenses of R&D in balance. Part 1	https://youtu.be/l_0xRovF4Nc
TOPIC 2.1 Final result of the expenses of R&D in balance. Part 2	https://youtu.be/CnrUmTsa9vg
TOPIC 2.2 Difference between transfer rights and lease expenses	https://youtu.be/xAO0b-fw0Fc
TOPIC 2.3 Goodwill	https://youtu.be/UkgAE3-RnPg
TOPIC 3. Financial instruments I.	
TOPIC 3.1 Dilution effect	https://youtu.be/HkZcpPsfCeI
TOPIC 3.2 Securities and premiums in fixed income	https://youtu.be/AkPIiLVqfn0
TOPIC 3.3 Profitability accrued and not due before purchase	https://youtu.be/6kz8fOL4fT8
TOPIC 4: Financial instruments II.	
TOPIC 4.1 Amortized cost as an evaluation criterion. Part 1	https://youtu.be/PNvZea7Qd30
TOPIC 4.1 Amortized cost as an evaluation criterion. Part 2	https://youtu.be/Xik_bZEcAHM
TOPIC 4.2 Explicit and implicit interest rate	https://youtu.be/cpyqa_xylFU
TOPIC 4.3 Accrued interest due and not due	https://youtu.be/GFfPuyACXhk

Source: Own elaboration.

Satisfaction questionnaire for evaluating the usefulness of the videos

The satisfaction questionnaire given to the students underwent qualitative validation by three expert reviewers in educational innovation from three different public universities[1]. Table 3 summarizes the validation process.

Table 3
Qualitative validation of the satisfaction questionnaire by experts

INITIAL	REVIEWER 1	REVIEWER 2	REVIEWER 3	COMMON	FINAL
QUESTION 1	✔	●	✔	●	QUESTION 1
	+	+	+	+	QUESTION 2
QUESTION 2	✔	✔	✔	✔	QUESTION 3
	+	+	+	+	QUESTION 4
	+	+	+	+	QUESTION 5
			+	+	QUESTION 6
	+			+	QUESTION 7
QUESTION 3	✔	✔	✔	✔	QUESTION 8
QUESTION 4	✔	✔	✔	✔	QUESTION 9
QUESTION 5	✔	✔	✔	✔	QUESTION 10
QUESTION 6	✔	●	●	●	QUESTION 11
QUESTION 7	●	✔	✔	●	QUESTION 12
QUESTION 8	●	✔	●	●	QUESTION 13
QUESTION 9	✔	✔	●	●	QUESTION 14
	+	+	+	+	QUESTION 15
			+	+	QUESTION 16
QUESTION 10	✔	✔	✔	✔	QUESTION 17
QUESTION 11	✔	✔	✔	✔	QUESTION 18
QUESTION 12	✔	✔	✔	✔	QUESTION 19

Legend: ✔ Validated; ✖ Eliminated; + Added; ● Modified
Source: Own elaboration.

Likewise, this satisfaction survey was quantitatively validated via a Cronbach's alpha test, yielding a result of 0.925 for a total of 106 students. Acceptable values range between 0.70 and 0.95 (Bland & Altman, 1997; Hair et al., 2019; Reyes-Menéndez et al., 2019), which indicate a low dispersion in the survey responses. Annex III lists the questions on the final questionnaire.

RESULTS

In this section, the results achieved in each of the phases of the project are analyzed.

Evaluation of student feedback and obtaining the map of difficulty of the subject

Starting with the information gathering phase, the results were analyzed, differentiating each of the three parts of the questionnaire and obtaining the generated difficulty map. All this information comprised the basis for the development of the videos.

Analysis of the responses obtained from the self-assessment

In this first part, the students had to answer five questions of a theoretical-practical nature on each topic. The results obtained are detailed in Table 4 and show that in general, across all the subjects, an average of three correct answers was not reached, indicating the degree of difficulty that this subject may entail for students.

Table 4
Descriptive statistics of the self-assessment questions

Descriptive statistics					
Correct answers	**N**	**Min**	**Max**	**Mean**	**Dev.**
TOPIC 1	138	0	5	2.72	1.25
TOPIC 2	107	0	5	2.54	1.35
TOPIC 3	106	0	5	2.72	1.45
TOPIC 4	98	0	5	2.84	1.34
TOPIC 5	89	0	5	2.74	1.18

Source: Own elaboration.

From a statistical point of view, the greatest dispersion is found in Topic 3, which is where more doubts may arise. If these results are assessed by topic, few questions reach a percentage of 75% correct answers.

Analysis of the difficulty rating questions

In this second section, students identify the degree of difficulty of the items that make up each topic using a Likert scale from 1 to 5, where 1 is the least complex and 5 is the most complex.

Regarding Topic 1, corresponding to tangible fixed assets, according to the answers in Table 5, none of the responses to the above items falls below 3 as a medium degree of difficulty. Therefore, we estimate that the degree of difficulty of this topic is medium-high. If we delve into the contents that create more difficulty, we observe that two in particular are close to 4. These points correspond to the subsequent valuation of nonfinancial assets, specifically, the problem of the reversal of the impairment of value and its accounting record.

Table 5
Descriptive statistics of the difficulty rating questions

	TOPIC 1			TOPIC 2			TOPIC 3			TOPIC 4			TOPIC 5		
	N	**Mean**	**Dev.**	**N**	**Mean**	**Dev.**	**N**	**Mean**	**Dev.**	**N**	**Mean**	**Dev.**	**N**	**Mean**	**Dev.**
LIK 1	133	3.16	1.01	104	2.98	1.01	95	3.19	1.10	90	2.72	1.10	79	2.67	0.93
LIK 2	132	3.35	0.95	101	3.10	0.85	95	3.00	1.15	90	2.88	1.16	79	3.11	1.03
LIK 3	132	3.02	0.99	101	3.22	0.95	95	3.33	1.00	90	3.27	1.07	77	2.56	0.92
LIK 4	132	3.14	1.09	101	3.49	0.84	95	3.69	0.92	89	3.53	0.91	77	3.16	0.97
LIK 5	132	3.32	0.98	101	3.27	1.02	95	3.28	1.02	89	3.24	1.01	77	3.16	1.04
LIK 6	132	3.29	1.06	101	3.23	0.97	95	3.45	0.98	89	3.36	1.07	76	2.91	1.09
LIK 7	131	3.47	0.96	100	3.39	0.99	95	3.41	0.94	88	3.42	1.12	75	2.84	1.09

LIK 8	130	3.55	0.97	100	3.37	0.98	95	3.29	0.99	88	3.32	1.09	75	2.77	1.03
LIK 9	130	3.86	1.02	100	3.59	1.03	95	3.43	1.03	88	3.64	0.98	75	3.57	1.08
LIK 10	130	3.39	1.08	100	3.19	0.93	95	3.53	1.02	87	3.55	0.89	75	3.16	1.05
LIK 11	130	3.24	1.10	100	3.05	1.10	95	3.48	1.04	87	3.45	0.93	75	3.27	0.92
LIK 12	130	3.37	0.99	100	3.46	1.02	95	3.83	0.97	-	-	-	-	-	-
LIK 13	130	3.72	1.04	-	-	-	-	-	-	-	-	-	-	-	-

Source: Own elaboration.

When analyzing the results obtained in Topic 2 on intangible assets, in general, we observe a degree of difficulty greater than three, which is medium-high. The concepts that are more complex refer to the subsequent evaluation. Therefore, the videos that are made for the previous topic are also useful for this topic. Another point that is difficult for students to understand is the assessment of research and development expenses and their activation process. The continuous changes and regulatory developments regarding goodwill, as well as the difference between transfer rights and rental expenses, are other points to which special attention is given in the development of the videos.

Topic 3, financial instruments, is one of the most complex topics in the course, as found when analyzing the self-assessment exercises. In this topic, the classification and characteristics of these financial instruments are studied, establishing the differences between shares and debt securities. These are the operations with shares, specifically, capital increases, which students perceive to have a high degree of difficulty. Specifically, more detailed explanations of the dilution effect generated in these extensions are needed, an aspect that is included in question LIK3.4 *(Topic 3, question 4)* in Table 5. When the representative debt values are studied, the students need to reinforce the calculation of their initial assessment, reflected in question LIK3.12. Specifically, students allude to difficulty when profitability is announced or accrued before the acquisition.

The results obtained in the assessment of Topic 4 referring to financial assets and liabilities at amortized cost reflect a medium-high degree of difficulty. The concepts that generate the greatest complexity are related to the amortized cost valuation criterion, the difference between implicit and explicit interest, and their accounting record. This information is recorded in questions LIK 4.4, LIK4.9 and LIK4.10.

Topic 5, in which the contents of net worth are explained, is generally the one that students perceive to have the least complexity. As Table 5 shows, there are fewer points in which the average degree of difficulty of 3 is exceeded. The issue that needs a more detailed explanation is the concept of refundable and nonrefundable grants and their accounting record when financing a nonfinancial asset.

Open question analysis

As Figure 2 illustrates, in the open question posed, the concepts that are more complex for the students are once again revealed in a free and unconditional way via questions from teachers. The responses recorded are typified by a search for links or common denominators.

As additional questions, they highlight the need to increase the number of exercises to be performed or to provide diagrams to facilitate understanding. This further justifies the use of videos as a tool in this project.

Figure 2
Typification of responses to the open-ended question
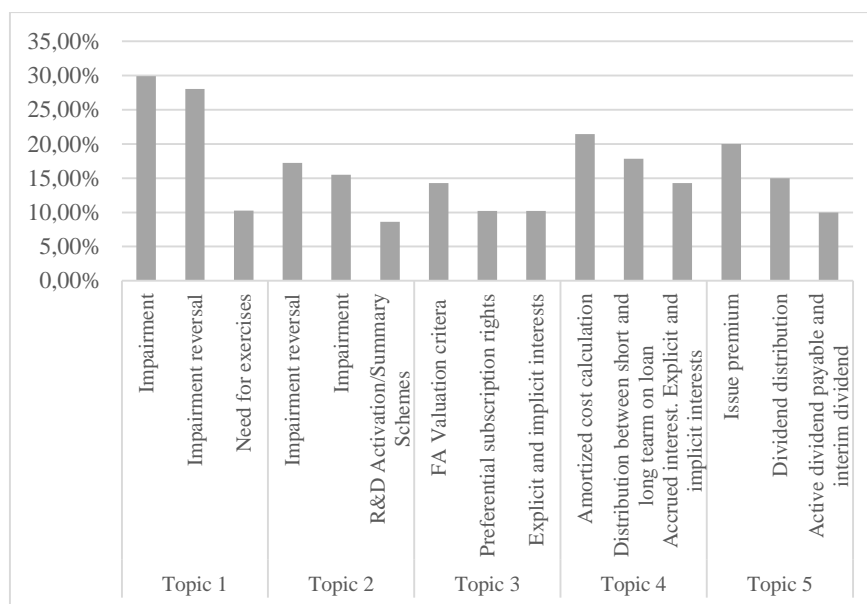
Source: Own elaboration.

Obtaining the difficulty map

To allow complexity assessment in a visual way, the difficulty map was constructed for each of the topics that make up the subject. For its elaboration, a series of criteria has been established that allows us to designate different colors akin to a traffic light, as Table 6 shows.

Table 6
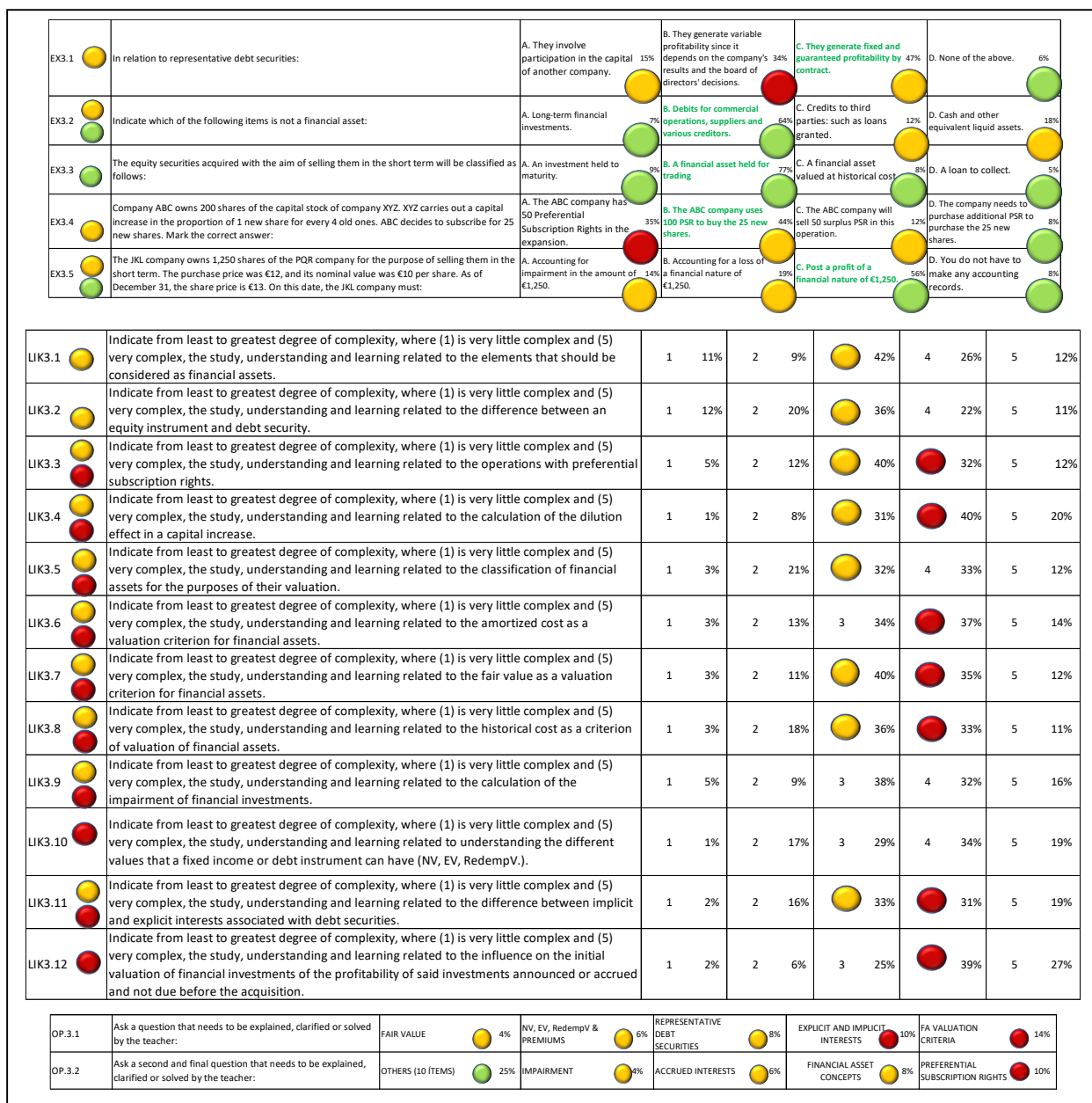*Definition of criteria for the construction of the difficulty map*

Established criteria	Result
PART ONE: self-assessment	
Records in correct answer (in%)	
Over 50	Green
Between 30 and 50 (or equal)	Yellow
Less than or equal to 30	Red
Records in wrong answer (in%)	
Less than or equal to 10	Green
Between 10 and 30 (or equal)	Yellow
Over 30	Red
SECOND PART: Degree of difficulty. Only if responses> 30%	
Likert 1 and 2	Green
Likert 3	Yellow
Likert 4 and 5	Red
PART THREE: open question (in%)	
Related concepts less than or equal to 2	Green
Related concepts between 2 and 10	Yellow
Related concepts equal to or greater than 10	Red

Source: Own elaboration.

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Figure 3 presents the resulting map for Topic 3 on financial instruments, showing the overall result for each question raised, which indicates low, medium, or high difficulty according to whether the color is green, yellow or red, respectively. To do this, previously defined criteria were applied to the recorded responses.

For example, for question 3, a low degree of difficulty is obtained because a percentage greater than 50% is registered concerning the correct answer and a percentage less than 10% was registered for each of the incorrect answers.

Figure 3

Difficulty map of Topic 3-Financial Instruments

Source: Own elaboration.

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Satisfaction survey results

Once the videos are made available to students, it is necessary to acquire their opinions of their usefulness in students' preparation in the subject. For this, a satisfaction survey was carried out; 106 responses were obtained, which we analyze below.

Regarding their perception of the subject, 62.26% of the students perceive it as difficult or very difficult, entailing work of more than 10 hours a week for 91.51% of respondents. The video tool, based on student difficulty rating, can reduce the degree of complexity of a subject in any field of knowledge without the need to significantly increase the time invested. Such videos have a predefined teaching orientation that guides students in their preparation. For instance, 80% of the students affirm that these videos allow them to deepen their learning of and preparation in the topics, and 85.85% consider their experience with the videos useful or very useful. Regarding technical quality, there is greater dispersion; on a scale of 1 to 5, 21% show a rating of 3, although, in general, students rating the format as high and professional quality total 77.36%.

These percentages indicate a real assessment, as more than 82% of the students claim that they have viewed all the videos or have left only one or two of them pending.

Notably, 82% of the students found them interesting or very interesting, reinforcing the usefulness of this methodology, given that none of the respondents deemed them a waste of time.

Finally, the positive perception of the degree of usefulness of the video tool reached 91% in the responses, a starting point for the promotion of the use of these applicable materials in both remote and face-to-face teaching.

Based on all the above results combined with the data obtained, we can therefore confirm that Hypothesis 1, "Students positively value the usefulness of video-based learning and its contribution to their preparation in the subject", is supported.

Evaluation of grades achieved without videos and with videos

First, Table 7 shows the main descriptive statistics differentiating the scores of students in the control group without access to the videos and those with it. The results are shown for both the ordinary call (May), the extraordinary call (June) and the final grade of the entire group while accounting for both.

Table 7
Descriptive statistics scores

		Mean	Dev.	Min	Max
No access to videos	May	5.19	2.18	1	9.6
	Jun	5.06	1.72	0.75	8.75
	End	5.81	1.96	0.75	9.6
Access to videos	May	5.30	2.89	0.38	10
	Jun	6.04	1.81	1.01	9.2
	End	7.73	2.04	0.74	10

Source: Own elaboration.

Gómez-Ortega, A., Macías-Guillén, A., Sánchez-de-Lara, M. A., & Delgado-Jalón, M. L. (2024). An effective video-based learning approach: a solution for complex university subjects. [Una propuesta efectiva de aprendizaje basado en videos: solución para asignaturas universitarias complejas]. *RIED-Revista Iberoamericana de Educación a Distancia, 27*(1), 345-372. https://doi.org/10.5944/ried.27.1.37569

According to the data in the above table, for both calls, improvement occurred among the groups of students with access to the videos. This improvement is reflected in a more significant way if the final grades obtained by each group of students are compared. In Figure 4, these final grades are graphically compared by category.

Figure 4
Comparison of final grades by category
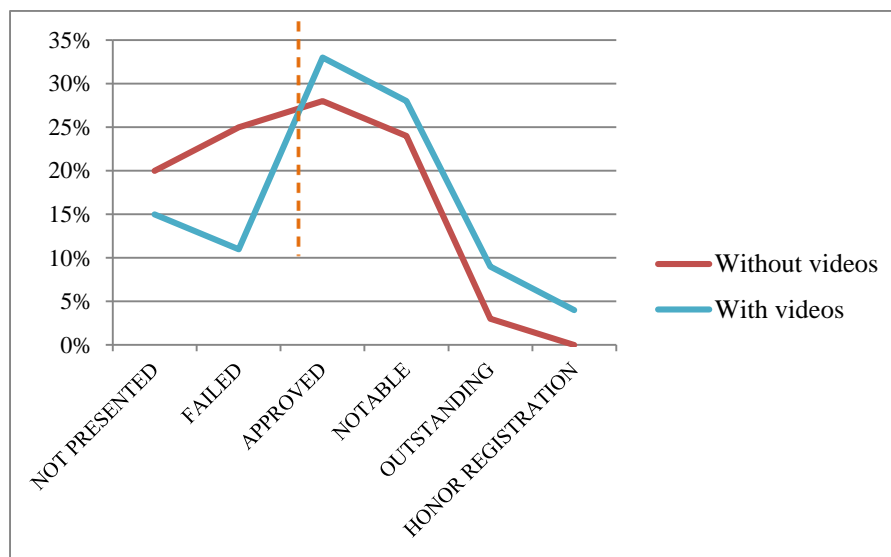
Source: Own elaboration.

At the global level, among the groups of students with access to the videos, there was less absenteeism during exams, which may indicate greater security among students who have this tool in their preparation in the subject. Likewise, there is a lower percentage of failure and a higher volume of passing. Notably, the highest scores are practically not recorded for the control groups. In addition, as Figure 4 shows, there is a very significant and pronounced change in the trend between failure and passing for the groups of students with access to the videos.

Statistically validating this comparison of results, Table 8 shows the results of the test of the difference of means among the final grades of students with or without access to the videos. Likewise, the results are shown for each call and each group, differentiated according to each of the three teachers.

Table 8
Test of difference of means and statistical significance

Variable	No access to videos		Access to videos		Difference of means test (p value)
	Mean	**Dev.**	**Mean**	**Dev.**	
Final_total	5.81	1.96	6.73	2.03	-4.43*** (0.00)
Final_Teach_1	5.82	1.72	6.40	1.72	-1.57* (0.06)
Final_Teach_2	6.70	1.85	8.44	1.58	-5.30*** (0.00)
Final_Teach_3	4.80	1.88	5.85	1.83	-3.14*** (0.00)
May_Teach_1	*4.98*	*2.02*	*3.57*	*2.56*	*3.27*** (0.00)*
May_Teach_2	6.29	2.03	7.98	2.23	-4.01*** (0.00)
May_Teach_3	4.17	1.98	4.75	2.06	-1.50* (0.07)

Gómez-Ortega, A., Macías-Guillén, A., Sánchez-de-Lara, M. A., & Delgado-Jalón, M. L. (2024). An effective video-based learning approach: a solution for complex university subjects. [Una propuesta efectiva de aprendizaje basado en vídeos: solución para asignaturas universitarias complejas]. *RIED-Revista Iberoamericana de Educación a Distancia, 27*(1), 345-372. https://doi.org/10.5944/ried.27.1.37569

Variable	No access to videos		Access to videos		Difference of means test (p value)
	Mean	**Dev.**	**Mean**	**Dev.**	
Jun_Teach_1	5.24	1.46	6.47	1.61	-3.42*** (0.00)
Jun_Teach_2	5.54	2.17	7.70	1.28	-2.79*** (0.00)
Jun_Teach_3	4.66	1.59	4.36	1.76	-1.96** (0.03)

Note: ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Source: Own elaboration.

According to the above data, the final grades obtained by students were higher on average in the groups with access to the videos, except for those of Teacher 1 in the May call. Furthermore, across all cases, the results are statistically significant.

Given this reiteration in the improvement in results for the groups with access to the videos, it seems reasonable to affirm that the video tool, based on the subject's difficulty, contributes to an improvement in students' performance.

Accordingly, the results obtained, both the descriptive findings and the difference of means test results, support Hypothesis 2, posited at the beginning of the study.

DISCUSSION

Video-based learning is becoming increasingly common in this era in which educational technology and multimedia learning are valued in society (Madariaga et al., 2021). Likewise, the literature suggests that its impact on the quality of learning requires involving students "during" the video design process. Along these lines, in this research, students were involved as the most important actors in the process; their feedback was considered a starting point, since they are the ones who best know what content is most difficult for them. They are thus precisely the ones who have positively valued the usefulness of the videos and their contribution to their preparation in the subject.

According to Campoverde-Luque et al. (2022), to achieve significant knowledge transfer, it is necessary for teachers to be properly equipped with digital tools and manage the resolution of exercises effectively and online; this notion reinforces the learning proposal based on videos presented in this research. In addition, to build this knowledge, there must be professional training in innovative methodological strategies, and that knowledge should be linked to practice (Bravo & Cáceres, 2006; Barrera et al., 2017), the main objective of these elaborate videos. The preparation of material obtained through this methodological process contributes to a reduction in the perceived difficulty, as well as to an improvement in results.

In relation to difficulty, Han and Ellis (2019) describe a methodology for developing the understanding of complex scientific concepts consisting of three stages: (1) identify the sources of misunderstanding of scientific concepts among students; (2) implement an effective instructional design to teach difficult and abstract scientific concepts; and (3) locate actionable elements in the experiences of students and their learning to find ways to impact the quality of their results. In line with this, a process has been carried out that can improve teaching practice in higher education when addressing content with a high degree of difficulty consisting of three stages: (1) collect information directly from students' feedback and by assessing their degree of complexity through a "map of difficulty"; (2) once the most complex issues have been identified, address them through training videos prepared ad hoc, as in the above

study; and (3) analyze the impact of the results, both in terms of satisfaction levels and ratings. The relevance of this methodology is that it can be completely extrapolated to any area of knowledge and educational level.

The present research confirms that this method, whose videos address highly focused questions and are adapted to specific learning objectives, allows students to delve into their preparation in focal topics. In contrast, it is less effective for them if these questions are formulated in a more generic way, in line with Schworm and Renkl (2007) and Renkl and Scheiter (2017).

Regarding the technical quality of videos in education, Dong and Goh (2015) analyze how to integrate videos into a teaching program, describe the technical requirements when producing such videos and advise, among other issues, on the quality thereof. The successful integration of video into a curriculum must be guided by the understanding of this technology. Videos must be credible and of good quality. In the methodology of this study, this perception was taken into account; the videos were first made by teachers and then later rerecorded by professionals in this field, ensuring the videos were perceived by more than 77% of students to be high-quality and professional.

In a previous study, Kim et al. (2021) have analyzed self-regulated learning strategies in an asynchronous online course, finding that an increase in students' engagement predicts their course performance. Additionally, the results of both the descriptive analysis and test of difference of means in the present study confirm improvements in both the motivation and academic performance of students. However, this study does not include a prediction study akin to that of Kim et al. (2021), opening a future line of research comparing the results of the above questionnaires with academic results to predict behavior. Such research can be completed by including, as a variable, the role of the emotions and socioemotional profiles of students in multimedia learning environments.

CONCLUSIONS

Following several years of a total break with previous teaching models and in a global context where virtuality is positioning itself as a necessary and complementary modality, we must maintain the adaptations and advances with respect to the previous methodologies, procedures and available resources. This means resuming teaching activities as they were previously carried out and incorporating improvements that have been proven advantageous for teaching quality (Medina López et al., 2021). In this context, information technology-enabled learning has become the heart of education since the COVID-19 crisis, with many teachers expressing their desire for good practice guides based on evidence and examples in their subjects (Cleland et al., 2020; Sangster et al., 2020). Notably, multimedia resources are a valid educational resource and, in a certain way, innovative, concerning instruction in university subjects, as long as they are oriented to specific knowledge objectives, as they constitute a very motivating element for students in the EEES framework (Camacho-Miñano et al., 2016).

Giannakos et al. (2016) state that video-based learning has tremendous potential, when it is pedagogically appropriate and purposefully designed, to facilitate teaching and learning. To use video as a pedagogical tool, it is necessary to examine its impact

on students' overall experience, given that the way in which intelligent learning can improve the didactic potential of video systems is of vital importance.

The emergence of digital tools has created new learning conditions, allowing an educational transformation (Rodríguez et al., 2023). In line with this, we have analyzed the usefulness of applying video instruction based on difficulty in complex subjects, using, as a pilot test, the subject of Financial Accounting II, to show that such instruction can be extrapolated to any field of knowledge. This work was openly presented to students through questionnaires specially elaborated for this purpose, enabling their analysis of the degree of difficulty of the different contents and allowing the final selection of the videos to be made. Once these videos were made and viewed by the students, we analyzed their impact and usefulness through two different methods: analysis of the results of a satisfaction survey subsequently carried out with the students and statistical analysis of the results in terms of the grades among students with or without (the control group) access to these videos for their preparation in the subject.

The first conclusion obtained is that videos are a very useful tool for students, providing them with complementary material adapted to their most frequent learning difficulties, which allows them to prepare for a subject with greater autonomy and greater chances of success. The second conclusion is that this system can be perfectly extrapolated to any subject; it is very interesting for teachers since it allows the identification of scales of difficulty in their subjects to address them in the best possible way.

In line with Gil-Galván and Gil-Galván (2021), this study is committed to the continuous development of the teaching process and the implementation of new methodologies that enable students to be protagonists in their own intellectual growth. Given all of the above, the results of this study should broaden the horizon of this project and be applied in related subjects, and even enable other teachers to implement the video tool in other areas of knowledge, thus providing greater robustness to the results obtained.

NOTES

[1.] The University of Las Palmas de Gran Canaria, the Complutense University of Madrid and Rey Juan Carlos University.

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Annex I. Examples from the first part of the questionnaire for Topic 3-Financial Instruments

1. **In relation to representative debt securities:**
   a. They involve participation in the capital of another company.
   b. They generate variable profitability since it depends on the company's results and the board of directors' decisions.
   c. They generate fixed and guaranteed profitability by contract.
   d. None of the above.

2. **Indicate which of the following items is not a financial asset:**
   a. Long-term financial investments.
   b. Debits for commercial operations, suppliers and various creditors
   c. Credits to third parties: such as loans granted.
   d. Cash and other equivalent liquid assets.

3. **The equity securities acquired with the aim of selling them in the short term will be classified as follows:**
   a. An investment held to maturity.
   b. A financial asset held for trading.
   c. A financial asset valued at historical cost.
   d. A loan to collect.

4. **Company ABC owns 200 shares of the capital stock of company XYZ. XYZ carries out a capital increase in the proportion of 1 new share for every 4 old ones. ABC decides to subscribe for 25 new shares. Mark the correct answer:**
   a. The ABC company has 50 Preferential Subscription Rights in the expansion.
   b. The ABC company uses 100 PSR to buy the 25 new shares.
   c. The ABC company will sell 50 surplus PSR in this operation.
   d. The company needs to purchase additional PSR to purchase the 25 new shares.

5. **The JKL company owns 1,250 shares of the PQR company for the purpose of selling them in the short term. The purchase price was €12, and its nominal value was €10 per share. As of December 31, the share price is €13. On this date, the JKL company must:**
   a. Accounting for impairment in the amount of €1,250.
   b. Accounting for a loss of a financial nature of €1,250.
   c. Post a profit of a financial nature of €1,250.
   d. You do not have to make any accounting records.

Source: Own elaboration.

Annex II. Examples from the second part of the questionnaire for Topic 3-Financial Instruments

Indicate from least to greatest degree of complexity, *where (1) is very little complex and (5) very complex*, **the study, understanding and learning related to:**

1. The elements that should be considered as financial assets _____
2. The difference between an equity instrument and debt security _____
3. Operations with preferential subscription rights _____
4. The calculation of the dilution effect in a capital increase _____
5. The classification of financial assets for the purposes of their valuation _____
6. Amortized cost as a valuation criterion for financial assets _____
7. Fair value as a valuation criterion for financial assets _____
8. The historical cost as a criterion of valuation of financial assets
9. The calculation of the impairment of financial investments_____
10. Understanding the different values that a fixed income or debt instrument can have (NV, EV, RedempV.) _____
11. Difference between implicit and explicit interests associated with debt securities _____
12. Influence on the initial valuation of financial investments of the profitability of said investments announced or accrued and not due before the acquisition _____

Source: Own elaboration.

Annex III. Satisfaction questionnaire regarding the usefulness of the videos

1. Enter your URJC email.
2. Indicate your year of birth.
3. Indicate your gender
     a. Female
     b. Male

4. In relation to the time you dedicate to the subject, please indicate how many hours you dedicate per week:
     a. I dedicate nothing or practically nothing.
     b. I spend up to 10 hours a week.
     c. I spend between 10 and 20 hours a week.
     d. I dedicate more than 20 hours a week.

5. Indicate how many times you have enrolled (counting on the current course) in Financial Accounting II:
     a. 1 (that is, only this year that we are studying)
     b. 2
     c. More than two.

6. Indicate, in your opinion after having taken this subject of Financial Accounting II (second semester), the DEGREE OF DIFFICULTY that you consider it to have compared to other subjects that you have taken in your studies, where 1 is the minimum value "very easy" and 5 the maximum "very difficult".

7. Do you think that the videos have allowed you to go deeper into your learning and preparation for the topics? Indicate the degree, where 1 is the minimum value "very little" and 5 the maximum "a lot".

8. Indicate your DEGREE OF SATISFACTION toward FINANCIAL ACCOUNTING SUBJECT II (second semester), where 1 is the minimum value "not satisfied" and 5 the maximum value "completely satisfied".

9. Indicate the DEGREE TO WHICH YOU LIKED the way in which the subject material has been complemented by the videos, where 1 is the minimum value "I liked it very little" and 5 the maximum value "I liked it very much".

10. Indicate the DEGREE OF USEFULNESS of this video experience, where 1 is the minimum value "very little useful" and 5 the maximum value "very useful".

11. Below is a list of the different videos made during this course for the subject of Financial Accounting II (they are not all broken down; because of some topics, several videos have been made, but there are all the topics that we ask you to evaluate). Please take a moment to remember and assess your DEGREE OF SATISFACTION with each of the videos (referring to the degree of understanding), where 1 is "very bad" and 5 "very good". *(The videos are listed by theme)*

12. Indicate, in general terms, if the TECHNICAL QUALITY of the videos seemed professional and adequate (the way in which they have been recorded), where 1 is the minimum value "very low/very basic format" and 5 the maximum value "very high/very professional format".

13. Indicate, based on your opinion as a student, the DEGREE OF USEFULNESS of the video tool for incorporating and promoting this type of material, applicable in remote teaching, where 1 is the minimum value "very little useful" and 5 the maximum value "very useful".

14. Do you consider the application of videos based on difficulty an interesting methodology for the better use, learning and study regarding a subject such as Financial Accounting II? Here, 1 is the minimum value "very uninteresting" and 5 the maximum value "very interesting".

15. Have you watched all the videos?
     a. Yes
     b. No (indicate in the following line the number of videos that you have been able to see)

16. Do you consider that viewing the videos has been a waste or a good investment of time? To indicate this degree, 1 is the minimum value "(they represent a waste of time") and 5 the maximum value "(they represent a good investment in time").

17. We are very interested in your opinion regarding the continuity of this experience. Briefly indicate the aspects that you consider could be improved in any of the areas (format, content, examples, sound, etc.). Thank you very much.

18. Indicate, with a simple sentence, any comment on your experience of using the videos in the study of the subject of FINANCIAL ACCOUNTING II. Thank you very much.

19. Do you give your consent to use the results of your survey in the teaching innovation project regarding the videos, based on difficulty? (any personal data will always remain anonymous). YES. NO.

Source: Own elaboration.

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