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Content

Editorial

Troubled Times for Ethics in Science and in the Use of Metrics

What a paradox that the publication of the new Scimago (Scopus) SJR 2022 has appeared precisely on 1st May, Workers' Day. Undoubtedly, in order to establish these metrics, tens, hundreds, thousands, tens of thousands of articles and cross-citations are needed to establish which journals are the most powerful, the most cited, and surely thousands of academics will be working on this theoretical day off to place one of their articles in one of the journals in the first quartile or, better, in the first decile of the SJR or JCR.

Education XX1 is one of these prized journals. It remains in the first quartile and increases its SJR impact index from 0.86 to 0.96. The CiteScore also reports good data: if in 2021 it was 5.7, the CiteSore Tracker for 2022, dated 5 April, already points to a value of 6.5. It is to be expected, therefore, that the current percentile in which it finds itself with the 2021 data (93rd percentile) may also improve and who knows if it can be placed in the top 5% of the world's scientific journals in education, a milestone, for which we must congratulate our Editor-in-Chief, Esther López-Martín, her entire team and, by extension, the Faculty of Education of the UNED.

Many other academics took advantage of the time off on 1st May to act as referees or to advance their work as scientific editors, both of which are unpaid. The work of editorial teams in our country is poorly recognized, requires great dedication and is not professionalized. Most national journals do not have financial resources, do not charge APCs and rarely have a stable budget and institutional support. Despite all this, the positioning of Spanish scientific journals in education continues to be excellent, especially if we are aware that we compete with large multinational publishing groups. In this scenario, it is not unusual for Spanish journals to begin to hand over their management to these large publishers, even if this means the appearance of an APC for publication. However, this situation is also a warning to our scientific community: publishing is not free, and someone has to pay the many production costs of a journal, despite the fact that editorial teams and

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reviewers continue to work without remuneration and almost without recognition. It is understandable, therefore, that teaching-research staff (junior and senior) who perform the functions of editors want to devote themselves to thankless and unworthy tasks such as typesetting, proofreading, article tracking, conversion to search engine languages (XML, etc.), reviewing citations in databases and so many other things necessary for a journal to function.

During the tension of having top scientific journals and surviving with this workload, there is the satisfaction of providing a quality service to colleagues and the academic world, as well as promoting Ibero-American scientific production and science in Spanish. However, in recent months there has also been discouraging news that affects the entire editorial world of scientific journals and, therefore, all academic and research staff who nourish the journals with our work and our reviews. The press has reported that highly cited researchers have been paid to change or add their byline affiliation to that of other universities (for example, changing the Spanish affiliation to that of an Arab or Russian university), with the intention that these universities will climb the world university rankings.

We have also read in the press that a researcher from Cordoba has been suspended from his job and salary for this reason. Is this possible, even though he dedicates himself 24x7 to research and even has a large team behind him? What is leading us to this behavior, to this ambition? Can we consider such behavior appropriate in the scientific world, does it raise ethical questions or are we turning a blind eye to it in a pact of indifference?

Navarro (2023) deals with these questions in a wry and humorous way in a newspaper article entitled Méteme en tu "peiper", quillo. The author rightly reminds us of Albert Einstein's words, referring to Marie Curie: "probably the only scientist who was not corrupted by fame".

On another note, Dr. Quaderi (2023), editor-in-chief and vice-president of Web of Science, surprised us on 20th March by announcing the de-listing of a group of 50 journals from their catalogue for no longer meeting their quality criteria. Quaderi explains that they have used IA to help them look for journals with extreme characteristics (*outliers*) that are indications that they no longer meet their quality requirements.

Analyzing these journals and the commotion generated in the networks, it seems that, among the reasons that have led WoS to take this decision, some reprehensible editorial practices stand out, such as certain strategies to receive citations in order to increase the journal's impact factor or the systems for generating special issues and carrying out peer review. It is increasingly common to find journals and publishing groups with "aggressive" publishing practices, offering reviews and rapid publication in exchange for high APCs. It seems that the exploitation of scientific production as a business is on the rise and, if we are

not careful, the ideal of science as a search for truth will be mortally wounded. But researchers, as we see, also seek to maximize their productive effort, either through journals where it is easier to publish, or by increasing the number of authors in articles excessively. The latter, which is difficult to control, is also being regulated by agencies such as ANECA.

The world rankings of university quality, basically focused on research, journal metrics and citation indexes of researchers to measure their impact or prestige (such as the h-index), have led to policies of selection, incentives and recruitment of faculty that are perverting the system. We are thousands of academics, we all want to publish a lot and in the best journals in order to receive incentives and get promotions, it is understandable. What if we create a journal or a group of journals that publishes many issues and an unlimited number of articles, we reduce review times as much as possible and publish very fast, and for this we ask for a good amount of Swiss francs, about 2000 or 3000 per article? Well, indeed, someone came up with the idea and several are following it. Analyzing one of these journals that has been *de-listed* from the WoS, in which quite a few Spanish academics in the field of education publish, we observe that it publishes 24 issues per year, with about 1000 articles per issue. It does not take a mathematician to calculate the income involved (a very profitable business) and the number of reviewers needed to evaluate such many articles, to which must be added the even more numerous rejected papers.

Authors such as Delgado López-Cózar & Martín-Martín (2022) have described these anomalous patterns of behavior in the publications of publishers such as MDPI and Frontiers (followed by others such as Heliyon, Plos One or Hindawi), and precisely show a significant mass of publications with Spanish authorship. Sánchez-Santamaría & Aliaga (2023) state that, to a large extent, this mass of Spanish publications is motivated by ANECA's teaching staff accreditation and six-year assessment criteria.

Logically, the teaching-research staff want to respond to the publication requirements of the Ministry of Universities, ANECA and the universities and their own departments: publish or perish. The publication costs will already be financed by some public body... And of course, the number of published articles multiplies, and the accreditation agencies begin to ask for more and better indexed articles because the vast majority already meet the above criteria (and of course, not everyone can be accredited and rewarded). So, faced with this global demand, some of these large new publishers offer the opportunity to publish quickly and sometimes easily, even giving authors various options to publish their work in journals in different quartiles depending on the amount of APC they are willing to pay. It may be a legal system, it may meet formal peer review criteria, but do we really believe that, with this system, we are creating quality science, that all that

glitters is gold? Becerra (2023), also analyzing some episodes of scientific corruption in the press, reflects on how the current obsession with reducing reality to metrics and rankings not only encourages mediocrity, but also ends up corrupting the reality it is intended to measure.

The temptation to stand out at any price can affect individual academics, but also journal editorial teams. Thus, criticism of questionable practices also affects some Spanish journals. In fact, in this latest publication of the SJR ranking, two Spanish education journals have been removed from the ranking. It seems, therefore, that the same two big companies responsible for the JCR and SJR rankings are aware of this drift and want to try to cut certain editorial practices that do not conform to their quality criteria and that devalue their own rankings. Although we publishers can also complain about the lack of transparency of these big companies about the criteria for the entry and exit of journals, at least we see here a concern for fair play.

However, within this pact of indifference to which we referred, it seems that we all look the other way as we achieve our goals. We know that all this deserves critical reflection, that university life is being degraded, that we do not have the necessary time to devote to our students, to teaching and to disciplinary study, but this does not seem to matter if people, departments, universities, and countries increase their positions in rankings that respond to indicators created by certain companies. The managers of ministries, agencies and universities got into the mechanics of comparing themselves in these rankings decades ago, possibly willingly and perhaps also too uncritically. These indicators, more typical of rich Anglo-Saxon countries, do not necessarily respond to all university models; moreover, it is healthy that there is diversity in the definition of the mission and vision of these large institutions.

I would hazard a guess that *impactfactormania* is beginning to crumble with the increasing advent of fraudulent practices. Perhaps a crisis is beginning to emerge that will force us to rethink what the university is, what its primary purpose is, what we expect from the relationship with our students, what the value of teaching is, how staff and institutions should be evaluated, where our value lies beyond the h-index (an index that defines no one as a teacher, nor as a researcher, let alone as a person).

We began this editorial by congratulating ourselves on the impact factor of our journal Educación XX1 and ended by criticizing the indiscriminate use of this factor. In short, in my opinion, the impact factor is just one more factor, among many others, to estimate the quality of an academic or an institution. We will see where the next decade will take us in science evaluation policies. I agree with Becerra (2023) when he warns of the enormous risks of turning metrics into a religion and of the feeling that metrics construct a world of lies. In other words, we surrender the true value of academics and universities to the “hyper-valuation of rankings” (Galán, 2020).

For there to be a deep, critical and academic reflection, it is necessary that, from the personal responsibility of each one of us, we leave this pact of indifference and debate once again about what the university really is and what we expect from it and its teaching staff.

Arturo Galán
Director

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Studies

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An exploration of institutional and personal barriers to online academic engagement at a Brazilian university

Una exploración de las barreras institucionales y personales para el compromiso académico en línea en una universidad brasileña

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ABSTRACT

The recent global pandemic has raised institutional awareness around the world concerning the importance of having high quality online learning options for students. Learner engagement is often correlated with quality outcomes such as student academic success and student satisfaction. Learner engagement is commonly thought of as having three important dimensions: affective engagement, behavioral engagement, and cognitive engagement (ACE framework). Engagement is also enabled or limited by facilitators/

barriers. Three important categories of facilitators/barriers are learner characteristics, personal environment, and course environment. Elements in each of these three areas enable or are barriers to students fully engaging in a course. This research explored what the barriers are to students fully engaging in their online courses at a Brazilian university to determine which areas will be most productive for the university program administrators and designers to focus on increase student academic engagement. A survey was applied to students from the Brazilian university under graduation online programs. It included items related to engagement facilitators barriers in the three areas described in the ACE framework and received 429 valid responses. The affective and behavioral dimensions were perceived by students as the lower engagement indicators in the ACE framework. Among facilitators or barriers for engagement, the ones under the course environment category were predominantly perceived as barriers, while learner characteristics and student environment were perceived as facilitators. However, all three categories were more barrier than facilitator for over 40% of the students. Although course environment is the barrier most under control of the institutions, understanding students´ personal environment and characteristics of learning can help them to provide support and facilitate full engagement in online courses.

Key words: online learning, student engagement, facilitators and barriers to engagement, higher education

RESUMEN

La reciente pandemia mundial ha aumentado la conciencia institucional en todo el mundo sobre la importancia de contar con opciones de aprendizaje en línea de alta calidad para los estudiantes. La participación de los estudiantes a menudo se correlaciona con resultados de calidad, como el éxito académico y la satisfacción de los estudiantes. Comúnmente se piensa que el compromiso del alumno tiene tres dimensiones importantes: compromiso afectivo, compromiso conductual y compromiso cognitivo (marco ACE). La participación también está habilitada o limitada por facilitadores/barreras. Tres categorías importantes de facilitadores/barreras son las características del alumno, el entorno personal y el entorno del curso. Los elementos en cada una de estas tres áreas permiten o son barreras para que los estudiantes participen plenamente en un curso. Esta investigación exploró cuáles son las barreras para que los estudiantes participen plenamente en sus cursos en línea en una universidad brasileña para determinar qué áreas serán más productivas para que los administradores y diseñadores de programas universitarios se centren en aumentar la participación académica de los estudiantes. Se aplicó una encuesta a estudiantes de la universidad brasileña en programas de pregrado en línea. Incluyó elementos relacionados con las barreras de los facilitadores de participación en las tres áreas descritas en el marco ACE y recibió 429 respuestas válidas. Las dimensiones afectivas y conductuales fueron percibidas por los estudiantes como los indicadores de compromiso más bajos en el marco ACE. Entre los facilitadores o las barreras para la participación, los de la categoría entorno del curso se percibieron predominantemente como barreras, mientras que las

características del alumno y el entorno del estudiante se percibieron como facilitadores. Sin embargo, las tres categorías fueron más una barrera que un facilitador para más del 40% de los estudiantes. Aunque el entorno del curso es la barrera más controlada por las instituciones, comprender el entorno personal de los estudiantes y las características del aprendizaje puede ayudarlos a brindar apoyo y facilitar el compromiso académico en los cursos en línea.

Palabras clave: aprendizaje en línea, compromiso académico de los estudiantes, facilitadores y barreras del compromiso académico, enseñanza superior

INTRODUCTION

The context for this study is a common one that has been repeated across the world in the last several years. The recent global pandemic increased awareness of the online learning practices within a prominent Brazilian university. University leaders recognize that quality online learning is an essential part of the learning options that should be available to students at a major university in the 21st Century. At the same time, the pandemic shone a light on many online educational practices that did not seem to be fully meeting the needs of students. Specifically, there was anecdotal evidence that online students were struggling to engage effectively in their educational opportunities.

In this study we present the story of a Brazilian university that used research to look carefully at student engagement in their online courses and to identify real facilitators and barriers to that engagement. We share how an instrument for identifying barriers was developed and used across the institution. We also share reflections of university stakeholders on barriers to student engagement and how they might be addressed. The purpose of this paper is to present a case study that we believe will be useful to many institutions of higher education experiencing similar challenges. It contributes significantly to the online student engagement literature by providing concrete examples and experiences of institutional and personal engagement barriers/facilitators at a world-class Brazilian university.

The Academic Communities of Engagement

The Academic Communities of Engagement (ACE) framework (Borup et al., 2020) was used to guide the study. The ACE framework was chosen because it was developed specifically for looking at engagement within online and blended contexts and it explicitly represents the relationship between facilitators/barriers and important dimensions of engagement. The ACE framework considers learner

engagement to be central and necessary to academic success of many types including achievement of learning outcomes, learning satisfaction, and persistence (Chen et al., 2018; Jung & Lee, 2018; Soffer & Cohen, 2019; Rajabalee & Santally, 2021). ACE represents learner engagement as a multi-dimensional construct with affective, behavioral, and cognitive dimensions (Martin & Borup, 2022). There are many factors that influence engagement which are referred to as facilitators of engagement (or barriers to engagement from the negative side). Examples of facilitators/barriers from the ACE framework fall into categories of (1) learner characteristics, (2) personal environment, and (3) course environment and will be discussed later in the paper. A challenge for engagement researchers is confusing facilitators with indicators of engagement (Halverson et al, 2019). Long-time engagement researchers (Skinner et al., 2008) distinguish facilitators/barriers this way, "Indicators refer to the features that belong inside the construct of engagement proper, whereas facilitators are the causal factors (outside of the construct) that are hypothesized to influence engagement" (p. 766).

Indicators of Engagement

The ACE framework builds on three dimensions of engagement identified in a seminal review of literature on engagement (Fredricks et al., 2004) and popularized in the Handbook of Research on Student Engagement (Christenson et al., 2012). Affective engagement relates to a student's emotional energy associated with a learning experience. For example, this might include positive emotions like excitement or belonging or negative emotions such as boredom, frustration, or loneliness. Behavioral engagement is represented by the physical observable behaviors and energy that students expend in the learning experience. For example, this might include elements like attendance, active participation, and submitting work. Cognitive engagement is represented by the mental energy exerted in the learning process. For example, this might involve the use of metacognitive learning strategies or giving persistent mental effort or attention to a learning task. The ACE framework identifies engagement indicators for each of the three dimensions of engagement which we have used to identify levels of learner engagement.

Facilitators/Barriers of Engagement

Engagement facilitators and barriers are the factors that influence the increase or decrease of learner engagement. Researchers have identified different categories of facilitators. For example, Halverson et al. (2019) identify personal

facilitators (like learner characteristics) and contextual facilitators (like the learning experience). Panigrahi et al. (2018) similarly identify personal and environmental factors as engagement facilitators. The ACE framework identified three categories of facilitators which include,

- Learner Characteristics - includes students cultural background, long term interests, dispositions, and motivations as well as self-regulation skills developed over time.
- Personal Environment - includes home and work conditions as well as personal communities that can support engagement.
- Course Environment - includes institutional and course conditions as well as the peers, instructors, and other supports to engagement.

More recently ACE lead author expanded the three categories of facilitators to include a fourth that is labeled "personal background" which could include historical and cultural factors influencing engagement (Martin & Borup, 2022). The course environment facilitators/barriers are the ones that universities have the greatest control over. However, it is still important for institutions to understand the facilitators/barriers in the other categories because it has an influence on the kinds of support that may be needed for learner engagement and ultimately academic success. For example, awareness of barriers in students' personal environment, including home and work conditions, is essential to designing online learning that meets their needs and can help them to successfully engage in their personal context. This study focuses on the three original facilitator categories in the ACE framework as the study was designed prior to the fourth category being introduced in 2022.

METHOD

In this study we used the ACE framework as a guide to understand the facilitators/barriers that students felt influenced their engagement (see Figure 1). The specific question university stakeholders were interested in was: What facilitators/barriers related to the course environment, personal environment, and learner characteristics did BUNIV online learners feel influenced their academic engagement?

This is a mixed-methods case study of an institution seeking to better understand the barriers students were facing to online engagement. The research was intended to deepen our understanding of the institutional as well as personal facilitators/barriers experienced by online students at BUNIV. We provide descriptive statistics from an exploratory survey to help provide the larger picture of categories from the ACE framework where significant percentages of students report they are

experiencing barriers. We use a thematic network analysis of open ended student responses to add emphasis to the barriers that students are most concerned about and willing to spend time elaborating on. Below we describe the context that the research took place in, the development of the survey instrument, and our data collection and analysis procedures.

Research Context

BUNIV has 37 online undergraduate programs, with approximately 6950 enrolled students. Those programs are 2 to 5 years long. Most of them are formed by 9 week-long courses, grouped in modules of 3 courses. So, students have 4 modules of 3 courses every year. Professors are hired to plan the course, produce materials, learning and assessment activities. Course mediation is conducted by an online adjunct instructor, not the same that designed the course or who teaches the course on campus.

Survey Development

The exploratory survey was developed in collaboration between online learning experts external to the university and internal stakeholders with responsibilities for online learning at the university. Two external experts and two internal stakeholders met weekly for several months reviewing the ACE framework and identifying categories and items that were connected to facilitators/barriers identified in the ACE framework and that seemed relevant to the institutional context. One of the experts was an original author for the ACE framework and peer debriefing on the development was sought from another original author of the framework. University stakeholders were particularly interested in a more qualitative and deep understanding of barriers to student engagement, so both a Likert scale (1=Very Strongly Disagree to 6=Very Strongly Agree) and open-ended questions were used. Generally, questions were stated in positive terms where scores 4-6 would indicate that the item facilitates engagement while scores 1-3 would indicate barriers to engagement with only a couple of items reversed.

The survey included items related to engagement facilitators barriers in the three areas described in the ACE framework (see Table 1). Initial items in each category were developed based on input from online learning experts as well as a knowledge of barriers experienced by online learning leaders at BUNIV. Internal consistency of the survey subscales was measured using Cronbach's α and were all considered acceptable to good: Affective Engagement (AE) (α=.757), Behavioral Engagement (BE) (α=.87), Cognitive Engagement (CE) (α=.747),

Learner Characteristics (LC) (α=.798), Personal Environment (PE) (α=.754), Course Environment (CE) (α=.839). The items in each category were exploratory and not intended to be exhaustive. For example, barriers related to learner characteristics were primarily related to student self-regulation (Cleary & Zimmerman, 2004; Panadero, 2017), but could have also included emotional aspects related to academic anxiety or stress. There were also obvious limitations to how long a survey could take without participants experiencing dropout due to survey fatigue. So, we acknowledge that this exploratory survey is not comprehensive, but that it does contain many important barriers/facilitators and we hope that important elements to students not included will surface in the qualitative data. Each section also included an open-ended question that allowed participants to identify additional barriers to their online learning engagement that might not have been identified in the items. Researchers developed the items in English and then had them translated into Portuguese (https://doi.org/10.5281/zenodo.7319503). The instrument was piloted with a small group of students and minor adjustments were made to clarify item wording based on their input.

Table 1

Engagement Indicators, Facilitators/Barriers and Items Included in the Survey Instrument.

Engagement Indicators and Items
Affective Engagement
(AE1) I highly enjoyed my online learning experiences.
(AE2) I did not feel frustration while learning online.
(AE3) I felt emotionally connected to others in my online learning experiences.
(AE4) Overall, I felt highly interested in the topics covered in my online courses.
Behavioral engagement
(BE1) I have been able to fully participate in my online learning experiences.
(BE2) I have made good progress towards my learning goals by consistently completing my online work.
(BE3) I have been able to spend the time needed to be successful in my online learning experiences.
(BE4) I have been able to manage my own efforts when learning online.
Cognitive engagement
(CE1) I have been able to consistently focus my attention on the online learning tasks I am working on.
(CE2) I have been able to exert the mental energy necessary to learn difficult concepts online.
(CE3) I have been persistent (not given up) in my online learning experiences.
(CE4) I have mastered effective online learning strategies (e.g., questioning, exploring, note taking, checking for understanding).
Engagement Facilitators/Barriers and Items
Learner Characteristics
(LC1) Goal Setting: I am able to set goals that help me succeed in my online courses.
(LC2) Time Management: I am able to set aside time weekly to keep up with online assignments.
(LC3) Help Seeking: I am able to seek online help to succeed in my courses.
(LC4) Self-Evaluation: I am able to follow through on instructor´s feedback to improve my academic performance.
(LC5) Motivation: I have a high personal motivation for studying online.
(LC6) Focus: I am able to remove myself from distractions while studying (e.g., phone, social media, email, games, etc.).
(LC7) Expectations: I expected that online learning would be easier (reverse).

Personal Environment

Study Environment

(PE1) Computer Access: I had easy access to a computer anytime I needed to study.

(PE2) Internet Access: I had easy access to high speed internet anytime I needed to study.

(PE3) Study Space: I had a study space free of distractions (for example, family interruptions, noise, clutter, etc.)

(PE4) Time Availability: I had plenty of flexible time to dedicate to my studies.

Home/Friend Support

(PE5) Affective Support: My family/friends encourage me to succeed in my education.

(PE6) Behavioral Support: My family/friends help me to make time for quality studying (e.g., encourage me to study, cover for me in other activities, remind me of my schedule, etc.)

(PE7) Cognitive Support: My family/friends help me in my studies when I don't understand something.

Course Environment

Course Design

(LE1) Organization - The organization of the courses made it clear what I needed to do to be successful.

(LE2) Materials - The course materials were helpful to my learning (relevant, appropriate amount, etc.)

(LE3) Assessment - The assessments were an accurate representation of what I have learned in the courses.

(LE4) Activities relevant - The learning activities were interesting.

(LE5) Activities interesting - The activities were directly connected to the learning outcomes of the courses.

Course Facilitation

(LE6) Online Communication - I had difficulty communicating online in the courses. (reverse)

(LE7) Instructor Interaction - The instructors were available to interact with me online.

(LE8) Online Feedback - I received helpful online feedback/explanations from the instructors.

(LE9) Interaction with Peers - I had opportunities to collaborate online with peers in my learning.

(LE10) Discussions - I participated in meaningful online discussions in my courses.

Data Collection

The survey was administered using Qualtrics. A link was sent by e-mail to students enrolled in all online undergraduate programs, except for freshmen (who did not have enough experience in the courses in order to reliably answer the questions), or 5416 students. The survey was available for 30 days, during the first month of the academic year. The answers were anonymous and voluntary and there were no compulsory questions. There were 429 valid responses, that means, at least one block of questions was answered. Four blocks of questions were proposed for students, and their sequence was random for each respondent: barriers related to course environment, barriers related to student characteristics, barriers related to personal environment and overall engagement. The existing dataset initially collected by the university for evaluation purposes, was approved by the Research Ethics Committee at BUNIV to be analyzed for research as it did not contain personally identifying information.

Data Analysis

The survey data was analyzed in two distinct ways. The quantitative data was analyzed primarily using descriptive statistics (generated using SPSS) which allow researchers to see patterns in the data related to student engagement and barriers to student engagement. The open-ended qualitative data was analyzed using a slightly modified approach to thematic network analysis as described by (Attride-Stirling, 2001). The lead researcher began coding for three global themes framed by the engagement barriers identified in the ACE framework (Borup, et al., 2020): course environment, personal environment, and learner characteristics. Initial basic codes were combined with similar codes into organizing themes. Then, in order to improve the trustworthiness of the coding, a second researcher was given the codebook with organizing themes and independently re-coded the identified basic codes using the themes that had been developed. Initial agreement for the organizing codes related to course environment were all above 88%, personal environment above 79%, and learner characteristics above 79%. Differences in coding were discussed until researchers were able to come to agreement regarding the codes. Visuals and descriptions of the thematic networks are available in the findings.

RESULTS

The findings will be organized around indicators of engagement (Table 2) and the three types of facilitators/barriers to online student engagement (Table 3) identified in the ACE framework: course environment, personal environment, and learner characteristics. A one-way repeated ANOVA was calculated comparing the three dimensions of engagement: affective, behavioral, and cognitive. A significant effect was found ($F(2,772) = 73.97$, $p < .001$). Follow-up protected t tests revealed that the differences between scores in the three dimensions as shown in Table 2 are statistically significant. We present these findings primarily to show that students' affective engagement in the online context was the lowest of the three dimensions which may have implications for the types of course facilitators that institutions need to consider emphasizing.

Table 2
Descriptive Statistics for Overall Engagement Dimensions

Engagement Dimensions	Mean*	SD
Affective Engagement (n=387)	3.55	1.25
Behavioral Engagement (n=387)	3.95	1.29
Cognitive Engagement (n=387)	4.15	1.21

* *Note.* Mean scores are the total for each category divided by the number of items.

Table 4 shows a comparison of how the students perceived the three categories. Of the three categories of barriers, the course environment barriers are the ones that universities have the most control over. We considered scores below 4.0 to indicate that the item or category was more of a barrier to engagement while scores greater than or equal to 4.0 were more of a facilitator to engagement. With this perspective in mind, each of the categories were more barrier than facilitator for over 40% of the students and a larger percentage of students reported barriers in the course environment than the other two categories.

Table 3
Descriptive Statistics for Facilitator/Barrier Categories

Barrier Type	Mean	SD	<4.0*
Course Environment (n=396)	3.98	1.02	49.0%
Learner Characteristics (n=401)	4.15	0.89	42.6%
Personal Environment (n=393)	4.23	1.00	41.5%

* Percentage of respondents who scored the item as more of a barrier than facilitator.

In each of the following sections we will explore the facilitator/barrier categories in more depth looking at both quantitative and qualitative data from the students.

Barriers Related to Course Environment

The course environment data consists of 10 items, five that are related to the design of the course and five that are related to the facilitation (i.e., human interaction) in the course. Table 4 contains descriptive data for all the course environment survey items. Lack of opportunities for peer collaboration and discussion were the lowest scores with the greatest number of students scoring them below a 4.0. Assessment was next with just over 40% scoring this item below a 4.0. All items except the two related to instructors (both interaction and feedback) had at least a third of the students score them below 4.0 in the barrier range.

Students had an opportunity to respond to an open-ended question about the course environment related barriers. This data helps us to triangulate the quantitative findings, identify potential elements that were not considered in the survey, and understand details of the student experience with barriers at a deeper level. Figure 1 represents the thematic network of the qualitative coding with 17 basic themes flowing into 8 organizing themes under the global theme of *course environment barriers*. Overall, 136 students left open ended comments that related to barriers in the course environment (the largest number of comments in the three barrier categories). The numbers in the thematic network represent the number of times that the theme was coded and is a soft representation of the prevalence or strength of the theme. In the sections below we will provide quotes to highlight the themes.

Table 4

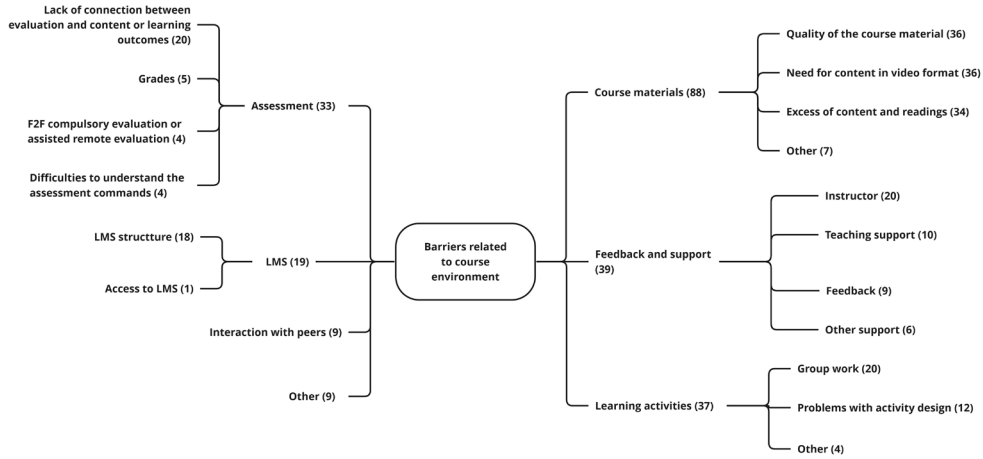
Descriptive Statistics for Items Related to the Course Environment

Barrier Type	Mean	SD	<4.0*
Discussions (n=398)	3.28	1.61	56.5%
Peer Interaction (n=398)	3.69	1.75	45.2%
Assessment (n=398)	3.78	1.61	40.5%
Online Communication (n=398)	3.93	1.74	39.7%
Materials (n=398)	3.99	1.59	37.4%
Activities Relevant (n=398)	4.04	1.55	35.2%
Organization (n=397)	4.10	1.60	33.8%
Online Feedback (n=398)	4.20	1.59	31.4%
Activities Interesting (n=398)	4.11	1.47	29.4%
Instructor Interaction (n=397)	4.61	1.44	22.4%

* Percentage of respondents who scored the item as more of a barrier than facilitator.

Figure 1

Organizing and Basic Themes Related to Course Environment Barriers (the numbers in the network represent the number of comments coded to the theme)



Course Materials

Course materials was the most commented barrier. Some students reported frustration with the quality of course materials and associated their learning with the use of other resources: "*My good performance is related to internet research and interaction with other students*" and "*The [course provided] content is all written ...and I learn by watching videos on YouTube*". Another student pointed out that there were "*a lot of irrelevant and outdated texts…where some excerpts of 30-40 sheets, only 5 sheets are useful*" and *"The course content is exhausting, too much text, few web conferences, the support material is insufficient and leaves something to be desired".* Many students expressed a desire for less text-heavy materials and more video content: *" It would be ideal to present regular video lessons with the content and use reading material only as a support".*

Feedback and Support

Sometimes students felt that instructors either didn't know enough about the course content or couldn't provide clear explanations, "*Often the meeting with instructors is irrelevant or not very guiding."* Some comments mentioned the lack of feedback on some activities, or that it was not promptly delivered: "*We do not have feedback from teachers regarding activities in which our performance was average or poor.*" They also desired more relevant feedback, which would result in opportunities to reflect on mistakes and correct them: "*I believe that the feedback system needs to be improved a bit, because when we do poorly on a project and we get the grade, we don't have the opportunity to learn and redo.*" *There is a lack of meaningful feedback. [...] but what I received was "that's missing...", "very good", and I believe that this is not quality feedback, it didn't make me reflect on my work, nor did it help me improve my weaknesses".*

Students desired closer contact with the instructor, so they could quickly ask questions without having to write them down and wait more than a day for an answer. One student commented, *"I should have faster access to the instructors because I have to wait another day to clear my doubts and I lose focus." Another added,* "*I like to have autonomy in my learning, but I miss a teacher who is more present in my daily life."* Some believed it would be nice to have more synchronous meetings with the instructor during the week: "*I realized that we don't have a direct channel with the teacher, which makes it very difficult to ask questions. Many questions are answered on the spot, not by e-mail and within 3 business days".*

Learning Activities

Comments about learning activities concentrated in complaints about group work, the design of learning activities and other less frequently mentioned factors. Many students reported difficulties communicating with their peers online and organizing teamwork, *"I believe group work can be better by creating a channel of communication with other peers. I know of the existence of the blog, but I believe that a direct channel with peers would be necessary"*. Also, students complained that some peers did not commit to the team. For example, one student said: "*One of the biggest difficulties is the development of work in groups, mainly because it is stressful to meet agendas and to communicate with peers sometimes, we have never seen before. Another factor is the lack of commitment of peers to group work*". Students mentioned they might spend more time figuring out how to organize the team than doing the activities. Online communication was often difficult and caused some students to express their preference to study alone. One student said: "*My experiences in group work have not been positive mainly due to a lack of communication*".

About activity design, students mentioned that activities did not fit the available time: "*The biggest barrier has been the lack of time, there is a lot of content in the disciplines*". Also, there were gaps between activities and availability of supporting course materials, as well as a lack of practical activities, "*The lack of exercises in the learning units leaves a lot of room for doubt*". Other comments mentioned the incompatibility between synchronous and asynchronous activities in blended courses, where there is an instructor responsible for assisting students with online activities and another teaching synchronous face-to-face classes.

Assessment

Most of the comments under this theme stated that there were assessment questions on the exams that were inconsistent with the content taught, "*We study based on the material provided during the weeks and when it comes time for the test, there is always a surprise. It gives the impression that whoever prepares the material is not the same as whoever prepares the tests*". Major assessments were often proctored face-to-face, so some students complained about the lack of flexibility that created, "*A barrier will be to go to campus to do a face-to-face assessment activity*". Finally, for some students, having assessments that focused on memorization rather than authentic activities was a barrier to their motivation for learning, "*I feel punished by these meaningless memorizing assessments*".

Learning Management System (LMS)

The LMS was considered a barrier as some students found it confusing and difficult to navigate, and some of them expressed missing guidelines and assistance. One student commented, "*It is complex to find activities, class content, scripts, etc.*" while another stated, *"there is a lack of guidance on the use of the platform. A confusing platform, difficult to navigate. And there is also a lack of people who know how to deal with people to help".* Finally, some students felt that the LMS did not adequately facilitate communication, a barrier was "*The lack of practicality in communication with colleagues and teachers. All done by a portal without online experience in real time, confusing".*

Interaction with Peers

Some comments demonstrated that students miss knowing their peers and being able to study and discuss with them: *"The low interactivity with peers and teachers does affect me a little. There are no debates that enable full academic development".* and *"Distance study can often be lonely, maybe it is a point that there's no way to change because we don't see our classmates every day .. At the end of every module, I always felt a little lonely, which demotivated me a little".*

Barriers Related to Learner Characteristics

The Learner Characteristics survey data consists of 7 items shown in Table 5. By far the lowest score and hence largest barrier in this category was student expectations that "online learning would be easier". Time management, focus, and motivation were also items in which more than a third of students rated below four in the barrier range of the scale.

Table 5
Descriptive Statistics for Items Related to Learner Characteristics

Barrier Type	Mean	SD	<4.0*
Expectations (n=404)	3.36	1.80	53.5%
Time Management (n=404)	3.96	1.59	37.9%
Focus (n=404)	4.05	1.56	35.6%
Motivation (n=405)	4.18	1.59	33.6%

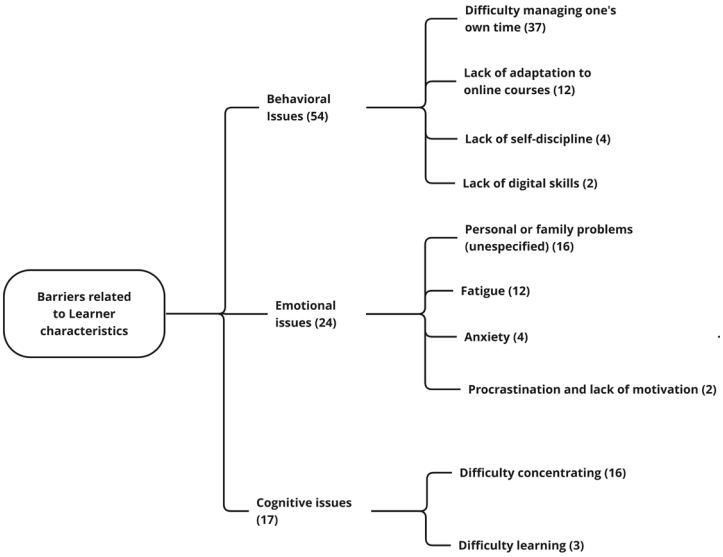
Barrier Type	Mean	SD	<4.0*
Goal Setting (n=405)	4.22	1.46	29.9%
Help Seeking (n=403)	4.35	1.54	29.0%
Self-Evaluation (n=404)	4.70	1.37	18.6%

* Percentage of respondents who scored the item as more of a barrier than facilitator.

A slightly larger number of students responded to this section of the survey than any other section, with 125 students elaborating on the learner characteristic barriers through a response to the open-ended question. The thematic network resulting from the coding of the open-ended question is represented in Figure 2. The barriers related to learner characteristics were divided in three organizing themes: Emotional Issues (24 comments), Behavioral Issues (54 comments) and Cognitive Issues (17 comments).

Figure 2

Organizing and Basic Themes Related to Personal Characteristic Barriers (the numbers in the network represent the number of comments coded to the theme)



Many of the themes correspond to items in the quantitative portion of the survey. For example, *difficulty concentrating* and *difficulty managing one's own time* in the thematic network are similar to *focus* and *time management* items in the survey. However, some personal barriers acknowledged by students including *emotional factors* and *digital competency* are important new elements raised by the students. The sections below provide qualitative details to support the basic themes identified.

Emotional Issues

Students mentioned emotional issues such as anxiety, procrastination, lack of motivation and fatigue, which were often associated with personal problems such as financial difficulties, unemployment, and family issues. Fatigue was often related to heavy workloads and the balance between work, family, and studies. So, certain conditions in the personal environment section such as work and study balance were associated with learner characteristics such as fatigue or motivation to study, creating a larger barrier to engagement. The quotes below exemplifies these situations.

> "Work's exhausting. When the workday ends, I just want to lie down and rest, because my work demands a lot from me. I spent the day thinking and consuming information, so when it ends, I feel like my mind has already been used up. I think that if I could go to the library every day it would be great, because I would be able to force myself to be awake studying, but because the costs of public transportation and the time is too late to come back home from the bus stop, I must study at home. The degree is important to me, so I'm going to find ways to get energy for studying".

> "Financial issues, familiar problems, mental suffering, loneliness, lack of time management, real lack of time, tiredness, exhaustion, poor diet, lack of friends and support, lack of social bonding, back pain due to be seat all day long and keep going after work doing a total of over 10 hours a day in front of the computer and just make me want to run out of the computer".

Behavioral Issues

The self-management of one's own study practices was considered a barrier for most of the students. Some students related that they had difficulty with time management, and they needed to learn how to schedule the time to study more effectively while others did not feel motivated to study or described themselves as

lazy. Others acknowledged difficulties organizing their schedules to focus on their coursework and to minimize the distractions at home.

Many of the students related that it was difficult to balance the time between work and study (31 comments) or between family and study (12 comments). And many times, this difficulty was associated with the excess of content and text to read. The comment below expresses these difficulties:

> "I work two jobs and study. I often lose concentration during very extensive readings. I have a lot of difficulty doing group work, which causes me a lot of frustration for not having the commitment of people who don't work and just study".

> "My biggest difficulty is the book readings…I work 8 hours a day from Monday to Friday and 4 hours on Saturday. I cannot read on the way to work. I find this kind of material exhausting. And the material I learn the most are the videos, which I can watch several times…I chose Online Course to make my life easier and not to make it difficult".

Another barrier was adapting to learning in predominantly asynchronous online courses. Some quotes exemplify these perceptions: *"I knew I would have difficulties with online learning, but the barriers are a little more complex than I imagined. I am afraid that in this matter only I can solve this problem, since the [BUNIV's] system is excellent."* and *"Studying alone without the support of at least one live class was very difficult. Discouraging".*

A few students reported that a lack of digital skills posed a barrier to their learning experience. For instance, some students expressed difficulty with activities involving folders and word processing, with one student stating, "*I don't have the knowledge to complete these activities*". Another student mentioned feeling overwhelmed by the influx of daily emails, and the pressure to deal with computer programs due to limited time and a lack of extensive computer knowledge, stating, "*I don't have vast knowledge to deal with computer/notebook and its programs*".

Cognitive Issues

The difficulty concentrating was another barrier described by the students. Some of them reported personal problems like lack of motivation, focus, and difficulty managing their own time, others reported that the noises at home made it difficult for them to concentrate. The lack of printed content was described as a barrier also and some students reported to have disorders such as dyslexia and attention deficit hyperactivity disorder (ADHD).

Another barrier was difficulty learning and the students pointed to external factors to explain the difficulties, for example: *"Sometimes I have difficulty with*

comprehension in the courses. Some teachers do not explain clearly." Another student pointed out that the difficulty with learning in the course was the lack of important prerequisite knowledge, *"I had a lot of difficulty with programming, I felt like I had to have studied programming as a prerequisite to start the course".*

Barriers Related to Personal Environment

Barriers related to the students' personal environments are reported in Table 6. The first four barriers are related to their study environment and involve access to computers and the internet as well as a distraction-free space to study and time availability to study. The last three questions relate to how supportive family and friends are within their personal environment.

Two items stand out as significant barriers for most of the students: time availability and family and friend's cognitive support. These are not surprising as many students engaged in the online programs are working full time in addition to having family obligations which restrict the time they have for studying. Additionally, for college-level courses, it is common for family and friends to be able to provide emotional and behavioral support, while they do not have the subject-matter knowledge to help with the cognitive aspects of the learning.

Table 6

Descriptive Statistics for Items Related to the Personal Environment

Barrier Type	Mean	SD	<4.0*
Family/Friends Cognitive Support (n=394)	3.14	1.84	56.6%
Time Availability (n=394)	3.34	1.62	56.3%
Family/Friends Behavioral Support (n=394)	3.84	1.73	42.1%
Study Space (n=395)	4.08	1.69	36.2%
Family/Friends Affective Support (n=394)	4.71	1.51	20.3%
Internet Access (n=394)	5.15	1.29	13.2%
Computer Access (n=395)	5.34	1.21	9.4%

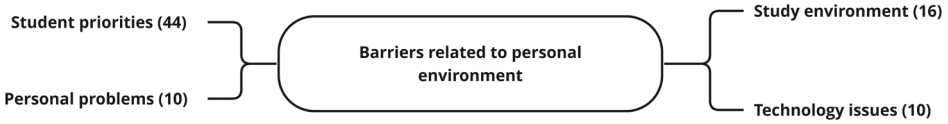
* Percentage of respondents who scored the item as more of a barrier than facilitator.

The next most prevalent barriers related to having a distraction-free study space and behavioral support where family and friends help make time for undistracted studying. Access to computer hardware and the internet were barriers to relatively few students (9.4% and 13.2% respectively), although these kinds of access barriers have the potential to significantly impact other dimensions like time for learning and the convenience of where students can study.

Figure 3 shows the thematic network with organizing themes for personal environment barriers. Comments were grouped under four organizing themes: study time and priorities, environment, relationships, and financial issues. These categories connect with challenges in the learner characteristics section. The nature of the comments under the personal environment dimension are discussed in the subsections below.

Figure 3

Organizing and Basic Themes Related to Personal Environment Barriers (the numbers in the network represent the number of comments coded to the theme)



Student Priorities

Comments grouped under this organizing code were often related to the lack of time to study, which was considered as a barrier to academic engagement for many students. Although some students simply mentioned they didn´t have enough time to study, "*I have little time available*", others reported having difficulties reconciling study and working and/or family hours, connecting with challenges categorized as behavioral issues in the learner characteristics section: "*I have a 1 year and 5 month old baby girl, she has Down Syndrome, so outside the work period I still have to accompany her in therapies and care at home, although my husband is very helpful I don't think I have the time that I would like to dedicate myself to studies*".

Study Environment

The study environment was a barrier pointed out by many students that mentioned problems like noise, interruptions, and ergonomics, "*In the environment where I study there is noise all day*"; "*Well, I don't have a very comfortable table and chair... This makes me feel a lot of pain while I'm sitting and studying*"; "*What hinders my performance is the interruptions in the middle of the study*".

Technology issues were also mentioned by some students, such as low internet speed or internet instability, computers that lacked audio and/or video, low performance computers for the course needs and sharing the computer with someone else at home, "*In the city where I live, there are a lot of power outages, the internet is very slow due to being a country town, which also affects teaching productivity*"; "*Old personal computer with poor performance*".

Personal Problems

Lack of family or friends support was considered a barrier by some students, "I have been feeling let down by my family and friends because they claim that the job prospects are disappointing and they charge me to enter the job market so that I can emancipate myself economically"; "In my case, my family's lack of understanding that an online college requires, if not the same level, a higher level of dedication and attention, had a huge impact on my availability to study". Some reported personal and family problems, "Recurrent family problems hinder performance and discourage a study routine", and some pointed out financial issues as a barrier, "Being with few financial resources stresses, demotivates".

Experiencing Multiple Barriers Across Categories

Students who experience multiple categories of barriers may be at greater risk for lower engagement. Table 7 shows that 37.5% of students experienced multiple categories as barriers (average score <4.0).

Table 7
Students Who Experienced Barriers in Multiple Categories: Course Environment, Personal Environment, and Learner Characteristics (n=368).

# categories scored as barriers	# of students	% of students
0	119	32.3%
1	111	30.2%
2	79	21.5%
3	59	16.0%

Note. A category was considered an overall barrier if the average score was < 4.0.

We also noticed that students with LC barriers often experienced the other barriers. Table 8 shows the correlations between the average scores in the three different barrier categories. The LC scores are correlated with the course and personal environment scores at almost double the level that the barriers in the two environments are correlated with each other. Additionally overall engagement was most strongly correlated positively with learner characteristics (.761) and second with course environment (.674) and least with personal environment (.413).

Table 8
Correlations Between Facilitator/Barrier Scores for Learner Characteristics (LC), Personal Environment (PE), and Course Environment (CE)

	Average CE Score	Average LC Score	Average PE Score
Average CE Score	1		
Average LC Score	.491**	1	
Average PE Score	.238**	.431**	1

** Correlation is significant at the 0.01 level (2-tailed).

Students with high barriers related to Learner characteristics (LC) often experienced higher levels of barriers in the other areas. To explore this observation, we divided students into two groups, ones where LC was considered a barrier (average LC < 4.0) and ones where LC was considered a facilitator (LC >=4.0). Table 9 reports the comparison of means across barrier categories under these conditions. Independent sample t-tests were run to verify that the differences in mean scores

were significant: CE results were (t(374)=9.067, p<.001, Cohen's d=.970), LC results were (t(399)=28.981, p<.001, Cohen's d=3.006), for PE (t(377)=7.113, p<.001, Cohen's d=.761). In all cases effect sizes as measured by Cohen's d were high and differences were especially high for the classification variable which is fairly normal.

Table 9

Group Comparison of Facilitator/Barrier Category Scores for Students Who Scored Learner Characteristics (LC) as a Barrier (<4) Versus a Facilitator (>=4)

	LC is Barrier (<4)			LC is Facilitator (>=4)		
Facilitator/Barrier Category	N	Mean*	SD	N	Mean*	SD
Course Environment (CE)	138	3.41	.920	238	4.31	.943
Personal Environment (PE)	145	3.18	.516	242	4.47	.970
Learner Characteristics (LC)	145	3.18	.516	256	4.70	.499

Note: Scores <4.0 were coded as barriers and scores >=4 were coded as facilitators

* Mean scores are the total for each category divided by the number of items.

DISCUSSION

This study examined which were the most important barriers to online academic engagement as reported by students of undergraduate online courses at a higher education institution in Brazil. The barriers were grouped in three categories identified in the Academic Communities of Engagement (ACE) framework (Borup et al., 2020): course environment, personal environment, and learner characteristics. Most barriers reported in the open-ended questions were related to the course environment, followed by student characteristics. In the following sections the findings on the research questions will be discussed.

Course Environment Barriers

Barriers related to the course environment were the most cited and are the ones under greatest institutional control. Those barriers could be addressed by appropriate course design strategies, so that learning activities, assessments, and course materials become more interrelated and more practical (e.g., connected to a real-world context). We learned anecdotally from BUNIV leaders that for online courses there is often a disconnect between course designers and faculty who are teaching the online courses and using the online materials. This challenge may limit

the kind of feedback loop that exists in traditional courses that allows for rapid adjustment of learning activities and materials that students experience. Evidence of these design barriers that are certain to increase cognitive load for students included among other activities that were not closely connected to intended outcomes, course materials that were lengthy and not concise, and materials that were very text heavy and didn't rely on the use of video and other visual media (Guo, et al., 2014). Institutional actions may involve refining course materials and organizing them to minimize extraneous cognitive load during learning (Kalyuga & Liu, 2015). Based on the cognitive theory of multimedia learning (Mayer, 2014), researchers have formulated some design principles for online learning with three main goals: reducing extraneous processing (by avoiding cognitive engagement with aspects not relevant to learning objectives such as irrelevant material, text, or narration redundancies), managing essential processing (by providing scaffolding for lessons), and fostering generative processing (by encouraging cognitive effort from students) (Mayer, 2019; Mayer & Fiorella, 2014).

Students also viewed lack of regular contact with faculty as a barrier to their learning. According to Pelikan et al., (2021) social interaction plays an important role in learning behavior and in the intrinsic motivation to study. Also, the communication via email and assignment feedback is not enough to motivate and engage students (Dennen et al., 2007). Converting courses to a bichronous modality by adding synchronous weekly schedules could be a possible solution to the students' reports about missing personal contact with the instructors and more relevant and frequent feedback (Lowenthal, et al., 2022; Martin et al., 2023). Additionally, discussion forums must be a place where students feel safe in asking and answering questions from colleagues. Collective discussion activities are opportunities for collective feedback that favor collaboration in learning and could support communities of investigation in the courses and instructors need to be trained with effective facilitation skills so that they know how to take advantage of the course design to help students (Martin, et al., 2019). Muilenburg and Berge (2005) conducted a large-scale exploratory study and found that students perceived a lack of social interaction as the primary barrier to effective online learning. Furthermore, their study revealed a strong association between social interaction and the effectiveness of online learning.

Some students complained about the need to do some assessment activities on campus. This can be connected to students' rushed life reported under learner characteristics and personal environment barriers and might be addressed with the use of online authentic assessments associated with educational technologies to supply the institutional need to certify the student identity in summative assessments.

Learner Characteristics Barriers

Some students struggle to organize their studies or their schedules, arguing they are not autonomous enough for the kind of self-study that online courses demand and that many were not aware of. In fact, there seemed to be a prevailing attitude among online students that online learning would be less rigorous. However, the prevailing understanding of researchers is that online learning generally requires a higher level of autonomy and self-regulation than traditional learning (Klingsieck, et al., 2012; Koçdar, et al., 2018). Academic self-efficacy positively influences students' regulations, and online instructors can promote students' academic self-efficacy through elements of teaching presence, such as course design and organization, facilitation, and direct instruction (Cho & Shen,2013). So, in order to help the students to thrive in the online courses, the institution might help students to diagnose their self-regulation abilities and provide some support for students who need to improve their skills in this area. Students mentioned that BUNIV has some initiatives to help students learn how to study, especially when they are taking their first undergraduate course, however, they did not feel that it was sufficient. Additionally, it is unclear whether those who need the help are actually getting it.

The study also revealed that students who experienced significant learner characteristic (LC) barriers also experienced greater barriers in the other two categories as well as experience overall lower engagement. While this study data is correlational and does not imply that LC barriers cause barriers in the other areas, programs that identify barriers at an early stage in the program, have an opportunity to implement institutional initiatives to help students with issues such as self-regulation so that they can thrive in online courses. Klingsieck, et al., (2012) mention that learning strategies plays an important role in student's ability to plan and regulate their study behavior. The inability to self-regulate is commonly associated with procrastination, which reduces the academic performance, increases in stress and anxiety levels and can also affect the engagement (Kim & Seo, 2015; Klingsieck, et al., 2013). Klingsieck, et al., (2012) point out that implementing strategies to prevent procrastination might strengthen students' abilities to self-regulate and organize their own learning.

To support student success in online learning environments, experienced faculty members recommend adopting a systematic approach to course design. This approach involves grouping course content in a meaningful way and providing clear and frequent guidance to students throughout the course, with explanations for the purpose of each activity and rubrics for all assignments (Kumar et al., 2019; Martin & Bolliger, 2018). Students themselves have identified course organization

as a critical facilitator of academic achievement in online learning (Fayer, 2014; Young & Norgard, 2006). Shin & Cheon (2019) reviewed 90 online courses using the Quality Matters rubric, and found that consistent course organization and a thoughtful amount of learning activities impacted positively on student satisfaction. Therefore, by organizing course content in a logical and meaningful manner, instructors can help students stay focused and engaged, which can lead to better academic outcomes.

To further reduce extraneous cognitive load during learning, LMS navigation can be made less complex and more intuitive. Investing in a mobile Learning Management System (LMS) is also a viable option to enhance student engagement in course activities. Studies have demonstrated that the integration of mobile LMS has positively impacted student achievement and learning satisfaction (Han & Shin, 2016; Shin & Kang, 2015).

Personal Environment Barriers

Conditions in a personal environment are stressful for many of the students because of conflicting student priorities, less than ideal study spaces, personal problems, and technology challenges. The personal environment barriers are amplified when combined with certain personal characteristics, such as difficulties with time management and lack of self-discipline. Other students need to balance study, work, and family duties. Many students complained that the workload online was greater than the expected work time for the credits. Kaymak and Horzum (2022) conducted a study at a public Turkish university to investigate the barriers that students faced in online learning and their impact on academic performance and perceived learning. Their findings indicate that time management and adequate support for studies were significant predictors of perceived learning, but they were not significant predictors of academic achievement in the context of online learning.

It could be useful for the institution to determine how much time they expect each activity in the courses to take and if that estimate is accurate with how much time it actually takes students to complete. Regarding technology, institutions could diagnose student's needs of hardware and software, and means of identifying areas where students may need support to reduce barriers in their personal learning environments. Also, talking to students about how to intentionally create a personal environment conducive to effective study could help many of them.

Students Experiencing Multiple Barriers

Finally, it is clear from the research that students at most risk are those experiencing multiple barriers. This study showed that over a third of students were experiencing overall barriers in multiple categories. In a recent study of online student engagement, Tuiloma et al. (2022) also documented that 46% of online university students in another South American country reported at least two barriers to online engagement with 31% reporting three or more barriers. More research needs to be done related to how institutions can identify and support students who are experiencing multiple barriers to learning - especially barriers related to learner characteristics and personal environment that are typically considered outside of the control of the institution. An important aspect of online learning is that it is increasing access to learning opportunities. However, current research is clear that more than physical access is important for there to be equity in online learning. Institutions also need to attend to the social resources and human resources that are often directly connected with reducing barriers outside of the course environment (Tate et al., 2022).

CONCLUSIONS

This study was done with one university in Brazil to better understand the different barriers to engagement that its online students were facing. Like most universities, BUNIV has its own unique online programs and processes. So while we hope the findings are transferable to other similar contexts, they are not intended to be generalizable in a statistical sense. Additionally, while the full population of online learners at the university were invited to participate, only a small percentage (7.9%) chose to respond. We do not have data to indicate how well the respondents represent the full population. Therefore the data is an important snapshot of actual perceptions and feelings but we don't know how well it generalizes to the whole population of online students. However, readers can learn from the efforts of BUNIV as they seek to understand barriers to engagement in their own university context. Future research can also be done to update the items and constructs in this exploratory survey using additional information about what was learned in the qualitative responses.

This exploratory study was able to pinpoint the most important barriers to online academic engagement that the participating students struggled with at the institution. Students identified course environment (CE) barriers to be the most significant for them. These barriers are ones that can be directly addressed with institutional support. Students identified several significant CE barriers including

lack of opportunity for peer collaboration and discussion, text-heavy and sometimes overwhelming course materials, limited interaction and feedback with instructors, and confusions with the learning management system (LMS) and organization of learning materials. These barriers are all directly within university control and can be addressed with policies and professional development to help improve the online and blended teaching skills of instructors.

Barriers related to learner characteristics (LC), involved challenges with managing one's own time and finding life balance. Other LC barriers mentioned by many students were of an emotional nature such as anxiety and severe fatigue that limited the ability to concentrate on learning. These barriers were often exacerbated by elements in their asynchronous learning environment such as unintuitive organization and lack of feedback that added cognitive load rather than reducing it. Future research might explore more deeply the nature of these emotional barriers and what institutions are doing to try and help address this barrier that online students are experiencing. Lastly, when looking at barriers related to personal environment (PE), busy and noisy spaces coupled with low internet bandwidth and overall low performance quality computers were stated to be an issue or barrier. Finally, fragile family relationships and lack of support from friends and employers was also a barrier reported by students. The study revealed that students facing LC barriers were often experiencing barriers in the other categories also. Future research might further explore causal relationships between barriers as well as expand LC barriers to include other emotional barriers identified by participants in the study.

This study provides concrete examples and insights into the barriers that online university students are experiencing when trying to participate in online learning. While university stakeholders have direct control over course environment barriers, it is also useful for them to understand underlying contextual barriers in students' personal environments as well as internal characteristics influencing the students' ability to engage fully. Institutions can learn to adjust the course environment and provide support for online students that can limit the effects of barriers to engagement in all three categories identified in the Academic Communities of Engagement framework (Borup, et al., 2020). Finally, this study makes a contribution to the ACE framework, by deepening our understanding and providing concrete examples of the three categories of student engagement barriers the framework identifies.

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Academic engagement in university students. The mediator role of Psychological Capital as personal resource

Engagement académico en estudiantes universitarios. El rol mediador del Capital Psicológico como recurso personal

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ABSTRACT

The COVID-19 pandemic has led to a deterioration in the quality of life and, particularly, the mental health of university students. This situation highlights the need to offer coping programmes and preventive mental health measures. The effectiveness of self-care programmes designed to increase well-being in students has hardly been studied, although promising effects have been found in some studies in the work context (Gomez- Borges et al., 2022). In line with JD-R theory, we conceptualize and empirically examine two resources, self-care activities and Psychological Capital (PsyCap), as antecedents of academic engagement as a positive state of well-being or fulfilment. These personal resources, self-care and PsyCap, can play an important role in meeting demanding situations such as those encountered by students

and, thus, contribute to their well-being. Therefore, the purpose of this study was to analyse the mediating role of PsyCap in the relationship between self-care and academic engagement. The participants were 397 university students from two Spanish universities (77.8% women; mean age 26.08 years). The data collection was carried out during the COVID-19 pandemic. We used structural equation modelling (SEM), and the results showed positive relationships between academic engagement and self-care, on the one hand, and PsyCap, on the other. However, the total mediation model obtained better fit and results, highlighting the mediating role of PsyCap. Based on the results, we discuss the importance of self-care activities for university students and, above all, programmes to develop personal resources such as PsyCap, in order to enhance their effect on academic engagement.

Keywords: university students**,** self-care, psychological capital, academic engagement

RESUMEN

La pandemia de COVID-19 ha provocado un deterioro de la calidad de vida y, en particular, de la salud mental de los estudiantes universitarios. Esto destaca la necesidad de ofrecer programas de afrontamiento y medidas preventivas de salud mental. La efectividad de los programas basados en el autocuidado para aumentar el bienestar en los estudiantes apenas ha sido estudiada, aunque se han encontrado efectos prometedores en algunos estudios en el contexto laboral (Gomez-Borges et al., 2022). En línea con la teoría JD-R conceptualizamos y examinamos empíricamente dos recursos, las actividades de autocuidado y el Capital Psicológico (PsyCap), como antecedentes del engagement académico como estado positivo de bienestar o realización. Estos recursos personales, el autocuidado y el PsyCap, pueden desempeñar un papel importante para afrontar situaciones exigentes como las que enfrentan los estudiantes universitarios en sus estudios, lo que puede contribuir a su bienestar. En base a ello, el propósito de este estudio ha sido analizar el papel mediador del PsyCap en la relación entre el autocuidado y el engagement académico. Los participantes fueron 397 estudiantes universitarios de dos universidades españolas (77.8% mujeres; edad media 26.08 años). Los datos se recogieron durante la pandemia de COVID-19. Utilizando modelos de ecuaciones estructurales (SEM), los resultados muestran relaciones positivas entre el autocuidado y el engagement académico, por un lado; y entre PsyCap y engagement académico por otro. El modelo de mediación total ha obtenido mejor ajuste y resultados, destacando el papel mediador de PsyCap. En base a los resultados, se discute sobre la importancia de las actividades de autocuidado en los estudiantes universitarios y, sobre todo, implementar programas para desarrollar recursos personales como el PsyCap que potencian su efecto sobre el engagement académico.

Palabras clave: estudiantes universitarios**,** autocuidado, capital psicológico, engagement académico

INTRODUCTION

In March 2020, a global alert was declared following the spread of Severe Acute Respiratory Syndrome (SARS-CoV-2), referred to as COVID-19. COVID-19 is a highly contagious and infectious respiratory disease that has become a pandemic and a public health problem with tragic consequences around the world.

The impact of the pandemic has not only had consequences for physical health, but it has also had a very negative effect on mental and emotional health (Heitzman, 2020; Hussain et al., 2020). Studies prior to the COVID-19 pandemic revealed that the context of university education has been affected by high levels of stress in its students, as well as the self-perception that they do not have sufficient tools to face the demands of academic and personal life. Nunes et al. (2014) reports a growing concern in university services about satisfying the great demands for mental health support from university students. In addition, Winerman (2019) reports that 45% of university students seeking psychological help experience high levels of stress, which is even more worrisome because the level of suicide among university students has tripled since the 1950s, making it the second most common cause of death in university students (Rosiek et al., 2016).

The post-pandemic deterioration in mental health has intensified the need to create more effective psychological health programmes to deal with this reality in university contexts. One possible strategy could be the implementation of psychological self-care promotion programmes.

The effectiveness of programmes based on self-care to increase well-being in students has hardly been studied, although promising effects have been found in several studies in the work context. These studies show the positive relationship between self-care activities and well-being (Fiodorova & Farb, 2021; Gomez- Borges et al., 2022). Well-being can be analysed from different approaches, including engagement. Different authors view engagement as a positive state of well-being or fulfilment (Schaufeli et al., 2002a, Salanova et al., 2011). Moreover, the academic engagement construct has been adapted to academic contexts (Martínez et al., 2019b; Salanova et al., 2010).

The purpose of the present study is to analyse the academic engagement of university students and its relationship with psychological self-care activities and Psychological Capital (PsyCap). In addition, this study refers to the specific period of the weeks of confinement due to COVID-19. In order to advance the relationship between students' psychological states such as PsyCap and academic engagement, we draw on the Demands and Resources Model (JD-R) (Bakker & Demerouti, 2017). Engagement involves a balance between the demands of a particular situation and the available resources to meet these demands. Personal resources are defined as psychological characteristics related to resilience and the ability to control and

positively impact one's environment, helping people to achieve their goals and encouraging personal and professional growth.

ACADEMIC ENGAGEMENT

Engagement is a positive psychological state characterised by vigour, dedication, and absorption. Originally, engagement referred to people's work activities (Schaufeli et al., 2002a), but it has also been extended to the academic context (academic engagement) and conceptualized in relation to students' tasks (Schaufeli et al, 2002b). Engaged students feel energetic, identify strongly with their studies, and are deeply involved in their academic lives. With regard to the three components of engagement, first, vigour is represented by a high level of energy and mental agility, reflected in a willingness to strive and persist in the face of adversity. Second, dedication refers to having a high degree of involvement in the work and experiencing enthusiasm, inspiration, and pride. Finally, absorption refers to the ability to be immersed in and enjoy the task at hand, and it includes the feeling that time passes quickly (Shaufeli et al., 2002b).

Students with higher academic engagement are more motivated in their studies (Loscalzo & Giannini, 2018) and have better academic performance (Salanova et al., 2010) and more positive emotions (Carmona-Halty et al., 2019). The Job Demands and Resources Model (JD-R) (Bakker & Demerouti, 2017) shows empirical evidence that personal resources (Gomez-Borges et al., 2022; Xanthopoulou et al., 2007) and job resources (Schaufeli & Bakker, 2004) are the most important predictors of work engagement, due to their extrinsic and intrinsic motivational potential. High levels of resources lead employees to be engaged at work. In turn, engaged employees report higher levels of well-being and exhibit better performance.

SELF-CARE

Self-care is defined as conscious and voluntary engagement in activities that promote psychological, physical, and emotional well-being (Myers et al. 2012). In other words, people must be aware that what they are doing is an intentional act of improvement. Self-care is a multi- dimensional and multi-faceted process of voluntary engagement in advocacy strategies that support healthy functioning and promote well-being.

In the JD-R model, Bakker and Demerouti (2017) incorporate actions and activities of employees based on their job demands and resources (e.g., job crafting, self- undermining, self-care) as personal resources. Some studies have related self-care to well-being in work contexts (Gomez-Borges et al.

2022). Colman et al. (2016) conducted a meta-analysis of which main self-care activities positively impacted greater life satisfaction, decreased distress, and self-compassion. The most beneficial activities were mindfulness, seeking social support, and other mixed activities, such as physical exercise in addition to mindfulness. In addition, several studies have found positive results of structured mindfulness programmes, such as increased positive affect, cognition, and psychological well-being (Depner et al., 2020; Garland et al., 2017). Furthermore, physical exercise refers to a subset of planned, structured, and repetitive physical activities with the ultimate or intermediate goal of improving or maintaining an optimal physical condition.

PSYCHOLOGICAL CAPITAL (PSYCAP)

With the emergence of scientific studies within positive psychology, there has been an increase in programmes and research in the area of positive education. These advances have allowed recent positive psychology constructs to be incorporated as PsyCap, which is considered a personal resource. PsyCap is characterized by hope, self-efficacy, resilience, and optimism (Luthans et al., 2006). Although Luthans' team initially focused on the study of work-related PsyCap, a growing number of studies have been carried out in the educational area (e.g., Datu et al. 2016, Carmona et al. 2019, 2021; Siu et al. 2014). In this context, PsyCap is a characteristic of students who manage to persevere in the pursuit and fulfilment of their goals and are able to adapt their strategies to achieve their goals (hope). Students with high PsyCap are also confident about their resources and capacity for goal achievement (self-efficacy), they overcome obstacles and adverse situations in order to achieve their goals (resilience), and they are optimistic about what is to come (optimism).

Specifically, in relation to PsyCap in students, some studies have shown relationships between academic PsyCap and motivation, academic performance (Luthans et al. 2015; Vanno et al. 2014), academic engagement (Datu and Valdéz, 2016; Martínez et al. 2019a), academic competence (Liao & Liu, 2016), and academic satisfaction (Ortega-Maldonado et al., 2017). Although these studies demonstrate positive relationships between PsyCap and many variables, there are no previous studies that analyse the relationship between self-care, as a personal resource, PsyCap and academic engagement.

In line with JD-R theory, as mentioned above, it is plausible that PsyCap, as a personal resource, promotes engagement. PsyCap is one of the personal resources that research has found to be relevant in relation to engagement (Schaufeli & Bakker, 2004). In the work context, employees with high levels of PsyCap perceive fewer job demands and bring higher job resources (Xanthopoulou et al., 2007). Therefore,

PsyCap can play an important role in meeting demanding situations such as those encountered by college students, which can contribute to their engagement. When high PsyCap students appraise challenges more favourably, they can perceive these situations as less demanding in relation to their personal resources. A perceived balance between demands and resources is vital for engagement. In contrast, low PsyCap students lack personal resources and are also likely to appraise their situations as less favourable and more demanding than their high PsyCap counterparts. Based on the above, we formulate the following hypotheses:

H1: There is a positive and significant relationship between Self-care activities and Psychological Capital

H2: There is a positive and significant relationship between Psychological Capital and Academic Engagement.

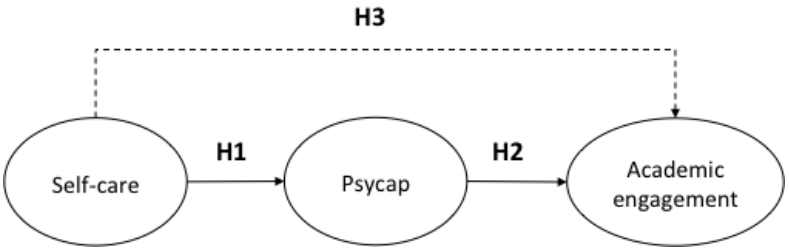
In this context, PsyCap would promote the use of other resources, such as self-care activities. High levels of PsyCap are associated with a balance between demands-resources and would enhance the effect of self-care activities on well-being.

So far, we have described the importance of self-care activities and their relationship with engagement. We have also presented the effects of PsyCap on engagement, due to its ability to enhance resources and meet demands. In addition, some research shows the importance of personal resources (self-efficacy, compassion, PsyCap) as mediators in the relationship between job resources and engagement (Carmona-Halty et al., 2021; San Román et al., 2022; Vink et al., 2011). Therefore, we propose that PsyCap has a mediating role in the relationship between self-care and engagement. In this way, high levels of PsyCap would enhance the effect of self-care activities on engagement, whereas low levels of capital would be associated with less use of resources such as self-care. Thus, the last hypothesis of this study would be the following.

H3: There is a positive and significant relationship between Self-care activities and Academic Engagement through the mediating role of Psychological Capital

As described above, a large number of studies refer to self-care and psychological capital as antecedents of well-being and engagement. However, we analyse these relationships in a specific context, during the weeks of confinement due to COVID-19, and in a special sample, university students. The model is displayed in Figure 1.

Figure 1
Proposed fully mediated model



Note. Dotted lines show no significant paths

METHODOLOGY

Sample and procedure

The participants were university students from two Spanish universities. The sample consisted of 397 university students (77.8% women; mean age 26.08 years, SD = 9.6) and included undergraduate students (78 %), master's degree students (13%), and PhD students (1%).

The information contained in this study was collected between the 15th of October and the 15th of December 2020, using an online survey. The questionnaire was hosted on the university intranet, and access was voluntary. All the questionnaires received were considered valid, and their responses were analysed. The Ethics Committee of the University approved this study.

Measures

Self-care activities. They were measured through a questionnaire containing seven self-care activities: physical (e.g., diet, physical exercise), psychological (e.g., mindfulness), and social (e.g., affective relationships with friends) self-care activities. The students answered according to their satisfaction with the activities carried out during the confinement period. The responses on these items ranged from 1 to 5 (1 = not at all satisfied; 5 = very satisfied).

Academic engagement. Academic engagement was measured with the short version of the Utrecht Work Academic Engagement Scale for students was measured with the short version of the Utrecht Work Engagement (UWES-S; Schaufeli et al., 2006; Schaufeli et al., 2002a). This version of the UWES-S contains nine items. The dimensions of engagement include feelings of vigour, dedication, and absorption.

Students had to respond by indicating how often they experienced these feelings during the first COVID-19 quarantine (e.g., "When I'm doing my work as a student, I feel bursting with energy"). Responses were given on a seven-point Likert scale (1 = never, 7 = every day). The UWES-S has been used in previous studies and has shown acceptable psychometric properties. (e.g., Martínez et al., 2019b; Schaufeli et al., 2002a).

Psychological Capital. Psychological capital was measured using a translated and adapted version (Martínez et al. 2019a) of the 12-item Psychological Capital Questionnaire (PCQ-12) originally developed by Avey, Avolio, and Luthans (2011).

This scale includes four dimensions: self-efficacy (3 items, e.g. 'I feel confident in presenting my ideas about my studies'); hope (4 items, e.g. 'If I should find myself in a difficult situation related to my studies, I could think of many ways to get out of it'); resilience (3 items, e.g. 'I can get through difficult times academically because I've experienced difficulty with my studies before'); optimism (2 items, e.g. 'I'm optimistic about what will happen to me in the future in terms of my studies'). Participants were asked to indicate the extent to which they agreed with the twelve statements on a seven-point scale ranging from 0 (strongly disagree) to 6 (strongly agree).

Control variables. To avoid alternative interpretations, we measured some control variables such as gender (i.e., women, men) and degree (i.e., bachelor, master, doctorate).

Data analysis

First, preliminary analyses were computed such as missing data, sample size calculations, normal distribution, means, standard deviations, Cronbach's alpha and omega coefficients, and bivariate correlations for all the scales. Also, to examine common method variance, Harman's single factor test (Podsakoff, et al., 2003) was carried out using AMOS 21.0 (Arbuckle, 2010) for the variables assessed by the participants (i.e., self-care, PsyCap, academic engagement).

Second, we performed structural equation modelling (SEM), by means of AMOS 21.0, using the maximum likelihood estimation method. According to Finney and Distefano (2006), the maximum likelihood estimation method is a robust method when the data have at least 5 response options, have a distribution close to normal, and the sample size is adequate. In order to test the hypotheses, four models were compared: M1, the fully mediated model; M1r the fully mediated model with errors correlated; M2r, the partially mediated model with errors correlated; and M3r, the alternative model with errors correlated. To compare the models tested, seven goodness-of-fit indices were assessed: (1) the $\chi 2$ goodness-of-fit statistic; (2)

the root mean square error of approximation (RMSEA); (3) the Normed Fit Index (NFI); (4) the Tucker-Lewis Index (TLI); (5) the Incremental Fit Index (IFI); (6) the Comparative Fit Index (CFI); and (7) Akaike's Information Criterion (AIC). Values below 0.06 for RMSEA and $p > 0.05$ for $\chi 2$ indicate a good fit. For the remaining indices, values greater than 0.90 indicate a good fit, whereas values greater than 0.95 indicate a superior fit (Hu & Bentler, 1999). Also, Kline (2011) suggested that, AIC can be used to compare competing non-nested models: the lower the AIC index, the better the fit.

RESULTS

Preliminary analyses

First, listwise deletion of missing data was performed guaranteeing less than 5% data loss rate (Fichman and Cummings 2003). Based on the recommendations for sample size calculations in structural equation model (SEM; Soper, 2023), 119 was the minimum required sample size to test the exact model fit with 14 observed and 3 latent variables in the model, .3 anticipated effect size, the .05 probability and .8 power level. In this study, the sample is composed of 397 participants, thus it has been guaranteed the minimum sample required in SEM analysis. Also, normality analysis was performed, revealing that skewness and kurtosis do not deviate too far from a normal distribution. Since parametric tests (such as SEM analysis) have been shown to be sufficiently robust for use in case of violation of the normality assumption (Schmider et al., 2010), it was decided to use parametric tests instead of nonparametric tests.

Second, Table 1 presents means, standard deviations, internal consistencies (Cronbach's alpha and omega coefficients), and bivariate correlations for all the study variables. Self-care is positively related to the Psycap dimensions (i.e., self-efficacy, hope, resilience, optimism) and academic engagement dimensions (i.e, vigor, dedication, absorption). With regard to internal consistencies indexes, scales provide appropriate values for their use.

Table 1

Means, standard deviations, reliability, and correlations for the study variables

Variables	Mean	DT	alpha	omega	1	2	3	4	5	6	7	8
1. Self-care	3.12	.76	.76	.76	-	.247**	.250**	.242**	.222**	.233**	.194**	.270**
2. Self-efficacy	4.25	1.34	.88	.88		-	.649**	.499**	.448**	.296**	.415**	.323**
3. Hope	3.69	1.36	.87	.87			-	.692**	.665**	.514**	.453**	.436**
4. Resilience	3.72	1.34	.57**					-	.652**	.373**	.324**	.390**
5. Optimism	3.63	1.51	.83	.83					-	.475**	.444**	.427**
6. Vigor	3,65	1.36	.86	.86							.714**	.802**
7. Dedication	4.23	1.43	.91	.91								.747**
8. Absorption	3.89	1.42	.85	.85								

** p<.05,**p<.01;***p<.001.*

Note. Resilience is made up of 2 items, so the consistency index cannot be calculated, opting for a bivariate correlation

Finally, the results of Harman's test (Podsakoff et al., 2003) revealed that a one-factor model (self-care, PsyCap, academic engagement) showed a poor fit to the data: [$\chi 2$ (77) = 983.393, p = .000, RMSEA = .17, CFI = .56, NFI = .54, TLI = .48, IFI = .56, AIC = 1067.393]. Results also showed that the three-factor model fit the data better than the one-factor model: [$\chi 2$ (74) = 260.767, p = .00, RMSEA = .08, CFI = .91, NFI = .88, TLI = .89, IFI = .81, AIC = 350.767]. The difference between the two models was also significant, in favour of the model with three latent factors ($\Delta\chi 2$ (10) = 722.626, $p < 0.001$). Consequently, common method variance is not a serious problem in these data.

Hypothesis testing

In order to avoid effect of confounding variables, gender and degree (i.e., bachelor, master, doctorate) were included in the model as a control variable. Then, different models were calculated to verify the hypotheses using SEM analysis (see Table 2). We expected PsyCap to fully mediate between self-care and academic engagement (M1). Although the relationships between the variables were statistically significant, some goodness-of-fit indices revealed a poor fit. Based on results of the modification indices, we correlated two errors in self-care scale (friends-family; $r = .46$, $p < 0.001$), in order to improve the model fit (M1r). The new model (M1r) showed a significant improvement in both the chi-squared value and goodness-of-fit indices ($\Delta\chi 2_{M1r-M1}=80.667$, $p < 0.001$).

Specifically, the path from self-care to PsyCap was positive and statistically significant ($\beta = .34$, $p < 0.001$), as was the path from PsyCap to academic engagement ($\beta = .59$, $p < 0.001$). This finding supported Hypotheses 1 and 2. To test the mediation hypothesis (Hypothesis 3), we used the product of coefficients method (MacKinnon et al., 2002). The mediated effect of Hypothesis 3 (self-care → PsyCap → academic engagement) was statistically significant ($P = Z\alpha \bullet Z\beta = 36.78$, $p < 0.05$). In addition, a partial mediation model was computed (M2r), but the direct effect between self-care and academic engagement was not statistically significant ($\beta = .09$, non-significant). Thus, these results suggested a full mediation effect.

Finally, in order to increase the credibility of M1r, we tested an alternative model in which self-care worked as mediator variable (M3r; PsyCap→ self-care → academic engagement). Based on the AIC index for competing non-nested models (Kline, 2011), M1r showed the lowest AIC value; therefore, M1r is better than M3r. It is interesting to note that in M1r, self-care explains 18.9% of the variance in PsyCap ($R^2 = 0.189$), which in turn explains 34% of the variance in academic engagement ($R^2 = 0.34$). The final model is illustrated in Figure 2.

Table 2

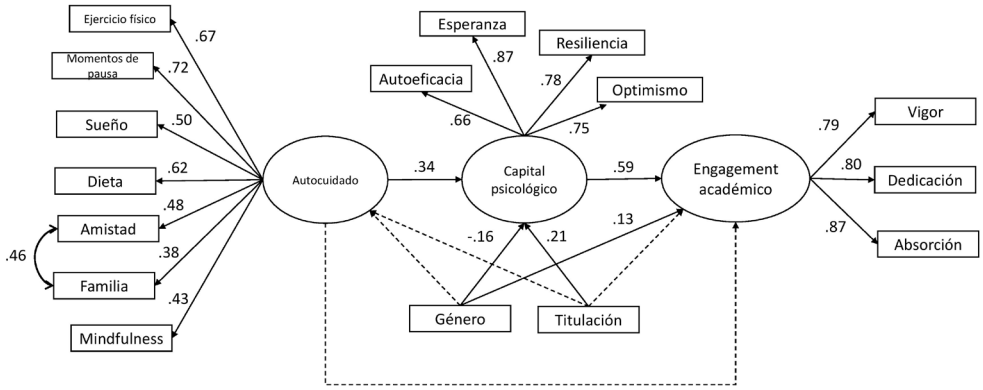
Goodness-of-fit indices for the SEM models

Model	χ2	*df*	*p*	CFI	NFI	TLI	IFI	RMSEA	AIC
M1	295.160	97	.00	.90	.87	.87	.91	.07	405.160
M1r	214.493	96	.00	.94	.90	.94	.94	.06	326.493
M2r	212.340	95	.00	.94	.90	.93	.94	.06	326.340
M3r	295.960	96	.00	.904	.87	.88	.91	.07	407.960

Note. M0= Harman's single factor test; M1 = Full Mediation Model; M1b Full Mediation Model revised; M2r = Partial Mediation Model revised; M3r = Alternative Model revised; χ2 = Chi-square; df = degrees of freedom; RMSEA = Root Mean Square Error of Approximation; NFI = Normed Fit Index; TLI = Tucker-Lewis Index; IFI = Incremental Fit Index; AIC = Akaike Information Criterion.

Figure 2

The final model with standardized path coefficients. Dotted lines show no significant paths



DISCUSSION AND CONCLUSIONS

This study was carried out in the special social and health context of COVID-19 with a sample of university students. The data refer to experiences during the weeks of confinement, and they were collected retroactively six to seven months after this confinement.

So far, and based on the JD-R model (Bakker & Demerouti, 2017), the purpose of this study was to examine the mediating role of personal resources (PsyCap) in the relationship between self-care activities and academic engagement.

The results supported our hypotheses, indicating that Self-care activities were positively related to PsyCap, which confirms Hypothesis 1. With regard to Hypothesis 2 (which proposes that there is a positive and significant relationship between PsyCap and Academic Engagement), the results also confirmed this hypothesis. Moreover, our study demonstrated significant mediation paths through Psycap. Specifically, Psycap was found to fully mediate the effects of self-care activities on academic engagement. PsyCap was explored as a mediating mechanism that may explain how students capitalize on their academic engagement. These results of our study are consistent with previous studies on personal resources and well-being (Gomez-Borges et al., 2022; San Román et al., 2022), specifically regarding the mediating role of these resources and their effects on engagement (Carmona-Halty et al., 2021; Salanova et al., 2011). In this direction, our results show that PsyCap is a powerful personal resource that could play a very important role on the prediction of positive outcomes. Self-care activities did not show direct effects on academic engagement when PsyCap was considered; therefore, it would be advisable to accompany the activities with the development of PsyCap to increase their effectiveness on the academic engagement of university students. We have analyzed the M1r (self-care → PsyCap → academic engagement) and M3r (PsyCap→ self-care → academic engagement) as possible models, considering in each case self-care activities and PsyCap as antecedents of the academic engagement. Although both models have shown positive relationships, the model that has obtained the best fit is the one that shows the effect of self-care activities on PsyCap (M1r). So this result could indicate the direction of the effect. For managers and those responsible for university management, these results provide some reasons to implement self-care programmes and healthy habits that, at the same time, can facilitate psychological development. Thus, academic engagement could promote positive spirals of psychological resource building, replenishment, and deployment, positive cognitive appraisals that facilitate motivation, effort, and, ultimately, performance, according to the JD-R model by Bakker and Demerouti (2017). In academic contexts, these relationships would be important in improving student grades and overall performance, as shown in Martinez et al., 2019b.

This study and its findings are important in many ways. The main theoretical contribution is that the study highlights the relationship between self-care activities and PsyCap and academic engagement. Therefore, as a practical contribution, the results reveal the importance of including programmes to increase self-care and PsyCap in academic settings. The results of this study are like others previously carried out in work contexts where successful interventions based on scientific evidence have been implemented.

Theoretical contributions

From a theoretical point of view, this paper extends the research on the JD-R model (Bakker & Demerouti, 2017) by providing evidence that, in a sample of university students, personal resources such as PsyCap could be considered processes underlying the relationship between self-care activities and academic engagement. In fact, in the world of work, Gomez-Borges et al. (2022) found in workers' samples that performing self-care activities promotes the perception of personal and work resources, which in turn enhances employee well-being. This study adds to the knowledge about the role of self-care activities in increasing personal resources in a sample of students. Moreover, the results broaden the knowledge about self-care activities in students and, therefore, add value to self-care programmes, making them more efficient and valid.

Practical implications

First, results from the present study suggest a promising way to increase academic engagement through psychological programmes and interventions designed to jointly develop self-care activities and PsyCap. Self-care activities are important, but the added influence of psychological capital enhances their effect on engagement.

Second, following the logic of our model, the results reveal the possibility of re-evaluating self- care intervention programmes and including practices related to PsyCap development. The results of this study seem to indicate that self-care practices alone cannot increase academic engagement because we also need to further develop PsyCap.

Third, from an educational point of view, educational institutions could develop holistic educational practices and policies. Applying these measures in the educational context can have effects like to those obtained in work contexts, given that engagement is positively related to performance (grades). Drawing a parallel with the workplace (Van Woerkom, 2021), actions addressing personal variables at

the individual level may have fewer lasting effects than actions that are integrated into the organization's mindset under a multilevel approach, such as educational policies. Finally, the results show the importance of promoting a culture of self-care in the education of university students, given that these practices enhance psychological capital and, therefore, academic engagement. To achieve academic engagement, we must pay more attention to its related variables, such as PsyCap and self-care, and universities must be more committed to psychologically and emotionally empowering their students, not only to prepare them to face the obstacles of university life, but also to empower them for their personal and professional lives.

Limitations and future research

The present study has some methodological and theoretical-practical limitations. First, a convenience sample was used, which might restrict the generalizability of these findings. However, the sample is heterogeneous because it includes students from different universities and academic years as well as gender diversity. Moreover, the study refers to a special social and health moment in the COVID-19 context.

Second, data were collected from self-report measures, which might have caused common method variance bias. However, considering the nature of the psychological experiences evaluated, it is difficult to employ other measures, such as objective, physical, or external agent measures. Furthermore, Harman's test showed that common method variance bias was not a threat to the validity of our results.

Third, the data are cross-sectional, and so we cannot draw firm conclusions about the causal ordering among the model variables. In order to mitigate this limitation, a third model was proposed (M3r) that provided some information about the possible direction of the relationships. However, future research should focus on developing longitudinal studies with experimental designs in order to uncover the causal order among the study variables.

Finally, although the present study has focused on the relationship between the aforementioned variables in a university sample, future studies could replicate the findings at different educational levels (e.g., high school).

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Perfectionism and academic engagement, the mediating role of passion for the studies

Perfeccionismo y engagement académico, el papel mediador de la pasión por los estudios

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ABSTRACT

In recent years, university institutions, together with the traditional interest in academic performance, are showing attention to the well-being of students. The concept of engagement tries to link both areas and suggests that there are motivational mechanisms common to well-being and performance. University adults choose to pursue high degree studies out of a desire for development that translates into a passion for learning. This passion has shown both positive and negative outcomes on well-being. Perfectionism has been shown to be a predictor of academic performance with different results in student health. For this reason, it is intended in the following work to analyze the relationship of perfectionism on the academic engagement and the mediating effect of passion for the studies, in 545 distance education university students, through a quasi-experimental design. Mediation analyzes are performed using the Partial Least Squares (PLS) method with SmartPLS software. Thus,

self-oriented perfectionism has a significant relationship with academic engagement, both directly and through passion, especially harmonious passion. A different effect is observed with socialized perfectionism. The model presents an adequate predictive level (Q2= [.435 - .630]). Therefore, passion constitutes a mediating variable between students' perfectionist beliefs and academic engagement in the study sample (SRMR<.08; R2= 45% *p*<.005). Theoretical and practical implications are analyzed, such as the importance of implementing strategies that encourage students to play an active, challenging, and flexible role in their learning process.

Keywords: perfectionism, engagement, passion, students, adult learning

RESUMEN

En los últimos años las instituciones universitarias, junto al interés tradicional sobre el rendimiento académico, están mostrando atención hacia el bienestar de los estudiantes. El concepto de *engagement* trata de vincular ambos ámbitos y sugiere que hay mecanismos motivacionales comunes al bienestar y rendimiento. Los adultos universitarios especialmente optan por cursar estudios universitarios por un afán de desarrollo que se traduce en una pasión por aprender. Esta pasión, ha evidenciado efectos tanto positivos como negativos sobre el bienestar. Por otra parte, el perfeccionismo ha mostrado ser un predictor del desempeño académico con resultados ambivalentes en la salud de estudiantes. Por ello, se pretende en el siguiente trabajo analizar la relación del perfeccionamiento sobre el *engagement* académico y el efecto mediador de la pasión en 545 estudiantes universitarios de educación a distancia a través de un diseño cuasiexperimental. Se realizan análisis de mediación utilizando el método Partial Least Squares (PLS) con el software SmartPLS. Los resultados señalan que las dimensiones de pasión armoniosa y obsesiva, y el perfeccionismo autocentrado y socialmente prescrito difieren en sus puntuaciones en *engagement* académico. Así, el perfeccionismo autocentrado presenta una relación significativa con el *engagement*, tanto directamente como a través de la pasión, especialmente la armoniosa. Se observa un efecto diferente con el perfeccionismo socializado. El modelo presenta un adecuado nivel predictivo (Q^2= [.435 - .630]). Por tanto, la pasión constituye una variable mediadora entre las creencias perfeccionistas de los estudiantes y el *engagement* académico en la muestra de estudio (SRMR<.08; R^2= 45% *p*<.005). Las implicaciones teóricas y prácticas son analizadas, como la importancia de implementar estrategias que fomenten en el estudiantado un papel activo, retador y flexible de su aprendizaje.

Palabras clave: perfeccionismo, *engagement*, pasión, estudiantes, aprendizaje adulto

INTRODUCTION

University students in late youth or early adulthood (World Health Organization [WHO], 2022) opt for their studies as a pathway for self-development or to pursue a vocation (Schneller & Holmberg, 2014). These students often have to combine family and professional obligations with their studies and opt for distance education. This student body has a high motivation for their studies, which enables them to cope with numerous obstacles (Carlsen et al., 2016). On the one hand, young adults' passion for learning entails dedicating time, developing an identity and feeling fulfilled according to achievement and vocational goals (Sverdlik et al., 2021). On the other hand, there is a thin line that relates achievement goals and perfectionism in academic performance (Méndez-Giménez et al., 2015). The latter, shows a complex relationship with academic performance, as perfectionistic efforts potentially do contribute to higher performance in the face of perfectionistic concerns that hinder and diminish students' well-being (Madigan, 2019). To understand these implications in the student's life, from positive education (see Seligman & Adler, 2019), we pursue to study the variables involved in the psychological well-being of students in distance education and in their academic success and what role they play (Williams et al., 2018).

One of the most widely used indicators to measure psychological well-being is engagement (Leiter & Maslach, 2017). This has been studied in the workplace and positive consequences have been found in workers such as higher motivation and performance, better health and less perceived stress (see Leiter & Maslach, 2017). It has also been analyzed in academia (see Barr et al., 2015; Lisbona et al., 2012; Merhi et al., 2018; Salanova et al., 2005). Engagement is defined as an enduring and positive state of mind with work (Leiter & Maslach, 2017) and includes three dimensions: vigor, referring to high levels of cognitive resources and persistence in coping with obstacles; dedication to the task performed or set of tasks; and absorption, or the ability to concentrate deeply, with the feeling that time "flies by". Therefore, academic engagement is considered a positive motivational construct where students are highly and intrinsically motivated (Salanova et al., 2005). This explains their greater persistence in the face of academic tasks and difficulties, or their higher academic satisfaction and performance (Salanova et al., 2005; Tinto, 2012).

Intrinsic motivation stems from the individual's own desires and needs; for example, vocation and enjoyment for the mere performance of the corresponding activity (Deci & Ryan, 2002). In this sense, passion and perfectionism would explain high student motivation and persistence to achieve academic engagement, especially in distance education students, where their motivations for study are closely linked to personal development (Schneller & Holmberg,

2014). Specifically, academic passion can be defined as a high motivation for studies, devoting significant time and effort to them, being a central part of a person's identity (Vallerand et al., 2020). It is a predictor of student happiness and satisfaction (Bernabé et al., 2014). According to Vallerand et al. (2020), there are two underlying processes for a person to develop passion towards an activity. The first is the valuation of the activity, either by interest, importance or experienced affectivity. The second is the internalization of it as part of his or her personal identity or the degree to which the activity represents the individual's self-concept. People with high passion will experience high motivation and persistence even in situations where a significant investment of energy and effort with high demands is required (Barr et al., 2015). This explains why passion is also an important predictor of academic performance (Vallerand et al., 2020). On the other hand, perfectionism is a multidimensional personality disposition toward the pursuit of excellence accompanied by high self-demand (Hewitt & Fleet, 1991). In academia, adaptive perfectionism is linked to higher levels of satisfaction, psychological well-being, self-esteem, high academic goals and greater self-determination (Lagos et al., 2017). However, the explanatory models of both variables show a "hidden side" for both perfectionism and passion. In both cases they have presented positive and negative consequences on students' well-being (see Vallerand et al., 2020). On the one hand, according to the dual passion model (Vallerand et al., 2020), passion can be either harmonious or obsessive. In the former, the student would study in a controlled and autonomous way, experiencing well-being for the pleasure of performing the tasks involved in his or her studies and learning. While, in the second, the student is emotionally dependent on the activity, perceives less control and is conditioned to the search and need for external rewards such as social acceptance (Lafrenière et al., 2012). Something similar has been observed in the processes of self-regulation of one's own learning, where Richardson et al. (2012) point out how autonomy and self-regulation contributed to internalize the activity as part of the individual's identity, due to the fact that responsibility is shifted to the individual, making him/her responsible for the goals that are set, in what terms and with what deadlines. This is in contrast to a totally externally regulated context in which the person would merely meet the deadlines already set. Thus, passion also acts as a regulator between beliefs and learning (Sverdlik et al., 2021). In this regard, Vallerand et al. (2020) link the experience of harmonious passion with positive affect and flow, whereas negative affect and anxiety relate it to the obsessive dimension of passion. Both dimensions are associated with persistence (Vallerand et al., 2020), understood as an active coping strategy, although they do not have the same experience. That is, persistence in the obsessive dimension would result more rigid, less self-controlled and less adaptive compared to persistence in those

students with high scores in the passion harmony dimension (Vallerand et al., 2020). This would contribute to explain the explanatory and differentiated role of harmonious passion with respect to academic engagement, in accordance with studies such as Lisbona et al. (2012). Thus, students who experience greater harmonious passion towards their studies devote sustained and persistent efforts over time to activities and situations that require a greater investment of personal energy even in the face of a low number of resources, obtaining more positive results (Bernabé et al., 2014).

On the other hand, regarding perfectionism and engagement, several studies initially linked perfectionism in general with more maladaptive coping and poorer outcomes (Hewitt & Flett, 1991; Madigan, 2019). Subsequent research (Verner-Fillion & Vallerand, 2016) evidenced that perfectionism shows both positive relationships with adaptive outcomes e.g., academic engagement (see Damian et al. 2017), and with maladaptive outcomes such as workaholism (see Stoeber et al., 2018). Specifically, according to Hewitt and Flett (1991), perfectionism can be classified into Self-oriented and Socialized, depending on whether the mandates originate, respectively, from oneself or are imposed by others. That is, depending on whether the person sets high standards of demand for a task or set of tasks and internalizes them as part of his or her identity. In the academic field, Flett and Hewitt (2014) analyze how self-oriented perfectionism, which presents a highly heterogeneous profile, is related to greater stress before exams. However, there is contrary evidence associating self-centered perfectionism with positive consequences such as positive affect, subjective well-being, life satisfaction, and academic performance (Ashby et al., 2012; Hewitt & Fleet, 1991). In contrast, the role of socialized perfectionism is more clearly linked to higher levels of both negative affect, depression, anxiety, stress, and poorer academic performance (Ashby et al., 2012). According to Jowett et al. (2016) it is externally imposed perfectionistic concerns that are negatively linked to engagement and positively linked to burnout, while those of internal and self-imposed origin are associated with an internal attribution of success and adequate academic performance (Aguilar-Durán, 2020). De la Fuente et al. (2020) points out different coping strategies depending on the type of perfectionism of the students. In the case of perfectionist efforts, the positive emotions experienced predispose to the use of problem-focused coping strategies and to engagement; in contrast, in the case of perfectionist concerns, negative emotions predispose to the use of emotion-focused strategies and to a state of burnout.

Madigan (2019), in her meta-analysis establishes that perfectionism, especially self-oriented perfectionism, has been linked to higher academic engagement given that those students with high standards of demand are more involved with the task, and invest more effort, motivation and perseverance. In a similar line, Stoeber (2012) evidenced in another meta-analysis the perfectionist eagerness with higher

academic performance. However, other authors do not observe conclusive results on the relationship between perfectionism and greater academic success (Stoeber & Otto 2006), psychological well-being (Lagos et al., 2017) or engagement (Jowett et al., 2016). Thus, it seems that the influence of other intermediate variables, such as passion that would explain these differences, (Madigan, 2019; Verner Fillon & Vallerand, 2016).

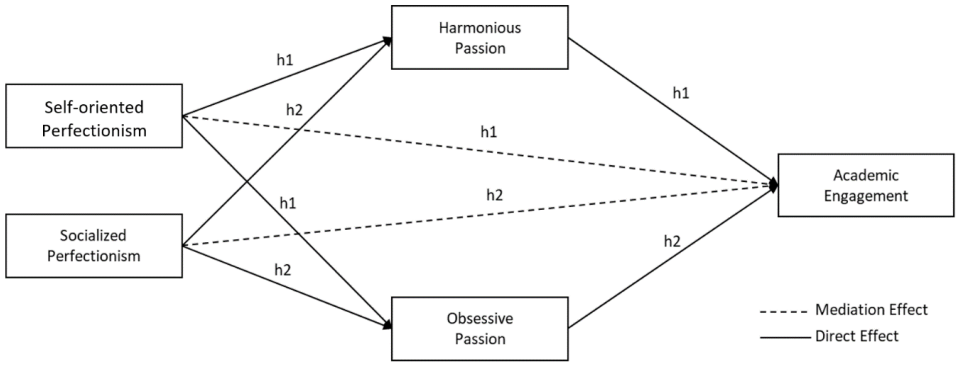
Perfectionism will be considered an antecedent of academic passion to regulate study (Verner-Filion & Vallerand, 2016), in the sense that it responds to a personality disposition and the passion construct is a more contextual and motivational variable. Specifically, self-oriented perfectionism shares with harmonious passion the higher degree of integration, attunement and alignment with the person's identity; on the other hand, socialized perfectionism has in common with obsessive-type passion its mainly external origin, less integration in the self and the experience of less self-control and greater negative affect. This autonomy, characteristic of harmonious passion, is one of the three basic needs of Self-Determination Theory (Deci & Ryan, 2002). Therefore, those variables and characteristics that are linked to this need will be linked to greater psychological well-being or engagement (Jowett et al., 2016; Lagos et al., 2017; Vallerand et al., 2020). Thus, the student with a higher level of self-demand will tend to study harmoniously and therefore will experience greater academic engagement. Whereas, if perfectionism is of external origin, the demand comes from external mandates, the passion would be obsessive or with less self-regulatory control and would be guided by social contingencies, experiencing lower academic engagement (Bernabé et al., 2014; Madigan, 2019). Therefore, the aim of the present study is to analyze the effects of perfectionism on academic engagement and the regulatory role of passion for studies as a mediating variable. Figure 1 shows the expected relationships Thus, it is expected, on the one hand, that self-oriented perfectionism will have a mediated effect, directly and inversely with the harmonious and obsessive dimension, respectively on academic engagement; and, on the other hand, that socialized perfectionism will present a direct relationship with the obsessive dimension and inversely with the harmonious dimension of passion and also differentiated effects on academic engagement. Specifically, the hypotheses of the present work are:

HYPOTHESIS

Hypothesis 1. Self-oriented perfectionism has a direct relationship with harmonious passion and an inverse relationship with obsessive passion and differential mediated effects on academic engagement.

Hypothesis 2. Socialized perfectionism has a direct relationship with the obsessive dimension and an inverse relationship with the harmonious dimension of passion and differential mediated effects on academic engagement.

Figure 1
Proposed theoretical model



METHOD

Participants

The sample was composed of 545 university students in late youth and adulthood [19 - 35 years]. All came from the National University of Distance Education. Most of them were undergraduates (97%) while the rest were studying for a university master's degree. The sample, of which 74% were women, had a mean age of 27 years (*SD*=4.13). 47.5% were in their 4th degree, 21.3% were in their 3rd degree, 26.6% were in the first years of their degree. 79.4% of the participants are pursuing health science degrees, 12.4% are pursuing social science degrees, 3.6% are pursuing engineering degrees, and 2.7% are pursuing educational science degrees.

Variables and instruments

Sociodemographic variables

An *ad hoc* questionnaire was developed to record the sociodemographic and educational variables of the participants. Thus, different scales were used to obtain information on gender, year of birth and current degree.

Perfectionism

Perfectionism was measured using the Multidimensional Perfectionism Scale (MPS) by Hewitt and Flett (1991) adapted to the Spanish population by Carrasco et al. (2009). It is composed of two dimensions: self-oriented perfectionism (e.g., "One of my goals is to be perfect in everything I do") and socially prescribed perfectionism (e.g., "My family expects me to be perfect"). Both are composed of 5 items. The items used a 5-point Likert-type scale (1= Strongly disagree; 5= Strongly agree). The internal consistency of the self-oriented perfectionism scale was α =.90 and α =.84 for the socialized perfectionism scale.

Passion

The Spanish adaptation of the passion scale for university students (Lisbona et al., 2012) was used. It evaluates the degree and level of passion regarding an activity where they invest time and energy. It is composed of two dimensions: harmonious passion (e.g. "I am totally involved in my studies") and obsessive passion (e.g. "My mood depends on whether or not I am able to learn something") of 6 items each. The response scale is a 5-point Likert-type scale (1= Completely disagree to 5 = Completely agree). The instrument showed an internal consistency of α =.81 and α =.83 for the harmonious and obsessive passion dimensions, respectively.

Academic engagement

The Spanish version of the Utrecht Work Engagement Survey (UWES-S; Schaufeli & Bakker, 2003) was used for students. It consists of 17 items, grouped into three dimensions: Vigor (6 items; e.g. "I can continue studying for long periods"), Dedication (5 items; e.g. "I am proud of doing this career") and Absorption (6 items; e.g. "I am immersed in my studies"). The response scale is a 7-point Likert-type scale (0 = Never; 6 = Always). The average of the scale as a whole is used as an indicator of academic engagement, showing an internal consistency of α = .93.

All the scales used show satisfactory internal consistency values according to Nunnally and Bernstein (1994).

Procedure

The participants completed a questionnaire using Qualtrics® that included the study variables. The time required to complete the questionnaire was 20 minutes maximum. Exponential non-discriminatory snowball sampling was used to recruit participants (Hernández Ávila & Carpio, 2019). Adult university students were contacted through subject forums where they in turn invited other adult students to participate. They were given a document requesting their participation and guaranteeing their anonymity and confidentiality in the answers provided. After giving their consent to participate in the research, they answered the questions. The study was conducted within the framework of the Declaration of Helsinki (World Medical Association, 2015) and in accordance with the norms of the UNED Bioethics Committee.

Data Analysis

Descriptive statistics (mean, standard deviation and correlation) and reliability analysis of the scales are analyzed. For the reliability analysis of the scales, values above .70 in Cronbach's alpha were considered as indicative of reliability (Nunnally & Bernstein, 1994). Subsequently, for the purpose of the study, the data were analyzed using the Partial Least Squares (PLS) method with the SmartPLS ® software (Ringle et al., 2005). For the analysis of the proposed model, the Partial Least Square - SEM (PLS-SEM) methodology was followed, since the objective is the prediction of the constructs of the proposed exploratory model (Hair et al., 2017). The objective of PLS is to predict dependent, latent and manifest variables by maximizing the explained variance (R^2) in the dependent variables and minimizing the error of the residual variance of the endogenous variables in any regression of the model (Wold, 1985). Thus, the technique is an alternative, robust and flexible approach to the traditional one (Martínez-Avila & Fierro-Moreno, 2018). Standardized data were used in the analysis and missing data were excluded. Significance was assessed by Bootstrapping with 500 samples of 100 cases (t-value = 1.96; $p < .05$).

To test the reliability of the model indicators, the composite reliability index (ρc) is considered. Values of ρc greater than .60 indicate good reliability (Werts et al., 1971). To assess convergent and discriminant validity, the Fornell-Larcker (1981) criterion was followed. Convergent validity would be sufficient for the model if AVE > .50. Discriminant validity would be satisfactory if √AVE (η1) > Cor (η1, η2). The HTMT criterion is also used, where the ratio must be less than 1 (Gold et al., 2001). Subsequently, for the study of multicollinearity of the variables that compose the structural model, the VIF value will be used, values lower than 5 are indicative of absence of multicollinearity (Hair et al., 2017). For the study of mediation effects, according to Nitzl et al. (2016), Confidence Intervals (CI90%) are estimated and Variance Accounted For (VAF) is calculated. A mediation effect occurs when the IC90% range does not contain the value zero (Hair et al., 2014). To assess the magnitude of the effects, VAF value > 80% is indicative of full mediation. In addition to the R2 as a predictive criterion, the Q2 indicator is examined to assess the predictive relevance of the structural model using the Stone-Geiser test (Geiser, 1974; Stone, 1974), values should be greater than zero (Chin, 1998).

RESULTS

Table 1 shows the descriptive analyses of the variables and the Cronbach's alpha values of the scales used. All correlations between variables are statistically significant ($p < .01$; $p < .05$).

Table 1
Descriptive and Reliability Analysis of the Measures

	M	*SD*	1	2	3	4	5
1. Self-oriented perfectionism	3.16	1.09	-	.33**	.19**	.36**	.21**
2. Socialized perfectionism	2.65	0.89		-	-.11**	.20**	-.10*
3. Harmonious passion	3.75	0.72			-	.18**	.67**
4. Obsessive passion	2.44	0.97				-	.31**
5. Academic engagement	4.26	1.10					-

** $p < .01$; * $p < .05$.

Regarding the proposed model (Figure 1), the composite reliability values of the variables that configure it are above .60 (ρc = [.88 - .93]) being indicative of an adequate reliability of the measures (Werts et al., 1971). Regarding convergent and discriminant validity in the model, for all constructs, the common variance between the indicators and their constructs was greater than .50 (AVE = [.55 - .83]). According to the criteria of Fornell and Larcker (1981) these values would be satisfactory. Furthermore, the square root of AVE is higher than the correlations with all the other constructs (√AVE = [.73 - .91]), so an adequate degree of convergent and discriminant validity among the variables is observed. Complementarily, the HTMT ratio for the correlations of the indicators shows satisfactory values (HTMT= [.10 - .72]), therefore, there is an adequate convergent and discriminant validity of the constructs in the model.

The proposed model reflects the indirect effect of perfectionism on academic engagement through its two dimensions, with no evidence of multicollinearity (VIF= [1.09 - 1.18]. In the model studied, an R2 = .45 is observed for academic engagement, being a moderate value (Hair et al., 2017). Additionally, regarding the predictive relevance of the structural model, the Q2 = [.435 - .630] values are adequate values of predictive validity of the model (Chin, 1998; Hair et al., 2017). Adequate levels of fit are also observed (SRMR < .08; R2= .45; p < .005). The coefficients of the structural model can be found in Table 2.

Table 2
Mediation of Passion between Perfectionism and Academic Engagement

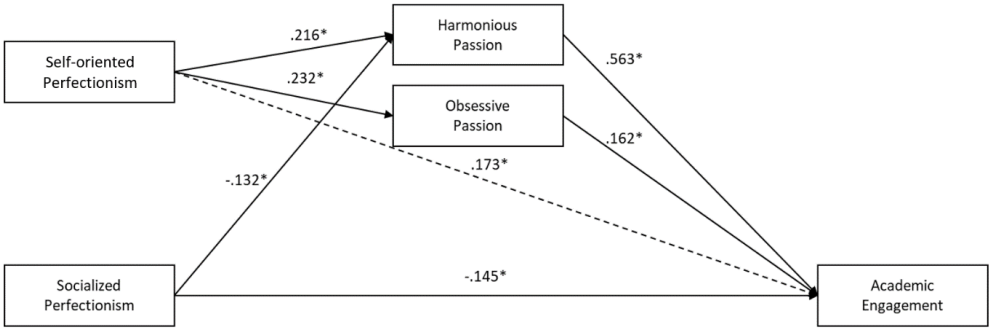
Effects	Coefficients	Bootstrap 90% CI				
Self-oriented perfectionism						
Direct Effects		**Percentiles**		**BC**		
Academic engagement	.067*	.005	.131	.005	.130	
Harmonious Passion	.216*	.139	.285	.140	.287	
Obsessive passion	.232*	.258	.377	.259	.378	
Harmonious passion - academic engagement	.563*	.503	.609	.505	.611	
Obsessive passion - academic engagement	.162*	.104	.223	.104	.223	
Indirect effects	**Estimated Points**	**Percentiles**		**BC**		**VAF**
Self-oriented perfectionism x passion						
PA – Engagement académico	.121*	.059	.144	.059	.144	63.9%
PO – Engagement académico	.051*	.034	.078	.033	.077	42.9%
Socialized perfectionism						
Indirect effects		**Percentiles**		**BC**		**VAF**
Academic engagement	-.145*	-.207	-.094	-.204	-.091	
Harmonious passion	-.132*	-.206	-.055	-.204	-.053	
Obsessive passion	.088	-.001	.177	-.002	.176	
Harmonious passion - academic engagement	.563*	.503	.609	.505	.611	
Obsessive passion - academic engagement	.162*	.104	.223	.104	.223	
Indirect effects	**Estimated Points**	**Percentiles**		**BC**		**VAF**
Socialized perfectionism x passion						
PA – Engagement académico	-.074*	-.114	-.031	-.114	-.031	33.8%
PO – Engagement académico	.014	-.000	.032	-.000	.032	10.8%
Total indirect effects	.158*	.112	.208	.111	.207	
Self-oriented perfectionism	.173*	.116	.229	.111	.207	71.6%
Perfeccionismo socializado	-.060*	-.106	-.011	-.107	-.011	29.2%

Note. Coefficients are significant IC: 90% BC: Bias Correct. VAF: Variance Accounted For.
** p-value < .05.*

Regarding mediation analysis, the results show indirect effects of self-oriented perfectionism on engagement both through the harmony dimension (β = .12; p = .000) and the obsession dimension (β = .05; p = .000). In agreement with Hair et al. (2014) VAF values > 20% and < 80% are obtained, indicative of partial mediation. Although the indirect effect is superior in the harmonious versus obsessive dimension, the differential effects between both mediators are not shown to be statistically significant in the case of self-oriented perfectionism (β = .05; CI90% = [-.011 - .103] BC= [-.010 - .104]). As for the effects of socialized perfectionism, an indirect effect on engagement is observed through the harmonious dimension of passion (β = -.07; p = .003 Vs. = .01; p = .082). This mediation would be partial (VAF = 33.8%). No significant direct effect of socialized perfectionism on the obsessive dimension of passion is observed (β = .08; p = .062). Thus, the total indirect effect of self-oriented perfectionism on engagement occurs through both harmonious and obsessive passion, with partial mediation in both cases. Socialized perfectionism, however, shows smaller total indirect effects and only marginally through the harmony dimension of passion (Figure 2).

Figure 2

Final model of Perfectionism, Passion and Academic Engagement



** p-value < .05.*

DISCUSSION AND CONCLUSIONS

The general aim of the present study was to analyze the indirect effects of perfectionism on academic engagement through the passion for their studies experienced by adult distance learners. First, it is observed that self-oriented perfectionism explains students' harmonious passion although the results are inconclusive regarding the relationship between socialized perfectionism and the obsessive dimension, in line with previous studies (Verner-Filion & Vallerand, 2016). On the other hand, regarding the passion experienced by students, the results show that although both types, harmonious and obsessive, are linked to high levels of academic engagement, it is harmonious passion that shows a stronger relationship for the sample analyzed, in line with previous work (Lisbona et al., 2012). Regarding hypothesis 1, in relation to the indirect effects analyzed, the results indicate that self-oriented perfectionism is linked to higher academic engagement when students experience harmonious and balanced academic passion. But, on the other hand, it is also observed that these self-imposed standards are related to certain degrees of study obsession and are not necessarily associated with lower academic engagement. Although the magnitude of the effect of harmonious passion on academic engagement is larger, the mediation effects do not differ from each other. One possible explanation for these findings is that both the desire to preserve the ideal self, fear of failure, and external evaluation by students converge to explain participants' academic engagement (Vallerand et al., 2020). However, in view of the results, students' internally derived perfectionistic beliefs seem to have a higher predictive role on academic engagement. This is explained because self-imposed standards of internal origin are associated with an internal attribution of successes (Aguilar-Durán, 2020), which raise the level of demand and therefore the motivation and persistence necessary to achieve such goals, so they will be related to a greater extent with the degree of academic engagement. As for hypothesis 2, socialized perfectionism is negatively related to academic engagement and harmonious passion; however, no mediation effects of obsessive passion with engagement are observed. Therefore, the results do not allow us to confirm the maladaptive consequences in students who study obsessively, without limits or control over study behavior. But they do point to the positive role of the adaptive effects of perfectionism in academia when studying is done in a balanced or harmonious way (Ashby et al., 2012; Hewitt & Fleet, 1991). It is observed, therefore, that greater autonomy and control in study behavior is linked to more adaptive coping strategies (Merhi et al., 2018) that regulate perfectionistic beliefs to achieve greater academic engagement. According to the resource conservation model (Hobfoll, 1989), studying with limits and in balance, characteristic of harmonious passion, acts as a personal resource that reduces the negative effects associated

with socially prescribed beliefs, such as loss of well-being, lack of control, or fear of external evaluation. On the other hand, studying without limits or guided by external approval or social prestige, characteristic of obsessive passion, reduces the adaptive role that perfectionist beliefs of internal origin may have.

The results therefore seem to indicate, in view of the indicators of the structural model, the explanatory role that students' self-oriented perfectionist beliefs have on academic engagement through the harmonious passion with which they approach their studies. Thus, self-imposed demands will be positively related to a more balanced and controlled study activity, while socially prescribed beliefs will be positively related to a less balanced and autonomous experience of the participants. However, the results found should be taken with caution because, according to the dual passion process model, negative consequences can be expected in the long term if perfectionist beliefs become rigid mandates of demand, which can lead to lower academic engagement by experiencing less harmonious passion, as the results suggest. This is a fine line where other variables may be at work, such as coping, perceived efficacy, resilience, or personal strengths (Merhi et al., 2018).

All the above, together, places the focus on the importance of implementing strategies from universities to foster in students a greater passion for their studies, through the acquisition of an active role in their learning and the establishment of challenging, autonomous and flexible goals. Promoting active student learning (Chickering & Gamson, 1987), through their own involvement in setting their own goals and standards will generate better academic engagement results, specifically with harmonious, balanced and more controlled passion. This phenomenon of the student as an active protagonist of his or her learning is also clearly linked to the impact on academic performance and satisfaction, thanks to greater self-regulation of learning. With it, the student actively participates in setting his or her own academic goals, internalizing them as his or her own (Chickering & Gamson, 1987). Precisely, one of the ways to promote a more balanced passion in studies goes through an adequate previous orientation based, for example, on the vocational preferences, personal and/or professional development and self-realization of the student (Harward, 2016; Tinto, 2012), without obviating flexibility in terms of achievement beliefs.

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Finally, although participation in the research was voluntary, which could encourage greater participation by more motivated students, the sample collected yielded a wide range of scores for the variables analyzed. It would also be interesting to find the differentiating effects of the variables analyzed with the incorporation of one of the indicators most commonly used to measure psychosocial distress, burnout. The introduction of academic burnout as a counterpoint to academic engagement could contribute in the future to obtaining a broader view in the analysis of student well-being or discomfort.

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The development of resilient behaviours in the fight against university academic dropout

El desarrollo de conductas resilientes en la lucha contra el abandono académico universitario

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ABSTRACT

The events that the health pandemic has brought with in recent times have accentuated the importance of personal and emotional factors in the training trajectories of students. For this reason, the study of resilience has become an important topic in the context of higher education, given the importance of this ability to cope with adversity and academic stress. In relation to this topic, the objective of this research was aimed at verifying whether students with greater resilience capacities had lower intentions of abandoning university education. The initial hypothesis was that those students with a low level of academic resilience had a higher risk of failing and abandoning the studies they had started. Following an ex-post-facto quantitative research approach, a questionnaire was applied to a sample of (n=412) students from all undergraduate degrees at the Faculty of Education of the University of La Laguna. The results showed that students with higher

levels of resilience show a higher intention to drop out and vice versa (less resilience, higher intention to drop out). At the same time, it was shown that a high percentage of students with low resilience expressed their intention to drop out, which highlights the predictive value of resilience in relation to academic performance. These results can help to have an understanding of the importance of this factor in the training trajectories of students, developing training and guidance actions that improve said competence and prevent situations of failure and academic dropout.

Keywords: higher education, resilience, student adjustment, dropout

RESUMEN

Los acontecimientos que en los últimos tiempos ha traído consigo la pandemia sanitaria, han acentuado la importancia que tienen los factores de carácter personal y emocional en las trayectorias formativas del alumnado. Por este motivo, el estudio de la resiliencia se ha convertido en un tema importante en el contexto de la educación superior, dada la importancia que tiene esta capacidad para hacer frente a las adversidades y al estrés académico. En relación a esta temática, el objetivo de esta investigación se orientó a comprobar si los estudiantes con mayores capacidades de resiliencia, tenían menores intenciones de abandonar la formación universitaria. La hipótesis de partida fue que aquellos estudiantes con un nivel bajo de resiliencia académica tenían mayor riesgo de fracasar y abandonar los estudios que habían iniciado. Siguiendo un enfoque de investigación de corte cuantitativo ex-post-facto, se aplicó un cuestionario a una muestra de 412 estudiantes de todas las titulaciones de grado de la Facultad de Educación de la Universidad de La Laguna. Los resultados evidenciaron que el alumnado que tiene mayores niveles de resiliencia, muestra una menor intención de abandono, y viceversa (menor resiliencia mayor intención de abandono). Al mismo tiempo, se demostró que un alto porcentaje de estudiantes con baja resiliencia manifestaron su intención de abandonar los estudios, lo cual resalta el valor predictivo de la resiliencia en relación al rendimiento académico. Estos resultados pueden ayudar a tener un conocimiento de la importancia que tiene este factor en las trayectorias formativas del alumnado, desarrollando acciones formativas y orientadoras que mejoren dicha competencia y permitan prevenir situaciones de fracaso y abandono académico.

Palabras clave: educación superior, resiliencia, adaptación del estudiante, abandono de los estudios

INTRODUCTION

In addition to the changes of various kinds that have been taking place in society as a whole, in recent times the population worldwide has been affected by a health crisis, which has altered many of the rules of how society functions and has forced it to adapt to a series of other changes resulting from the pandemic for which many were not prepared. Thus, in recent decades, terms such as dissatisfaction, stress, depression, anxiety, burnout, negative thinking, suicide, etc. have begun to be used frequently, which highlights the importance of many negative situations and realities in which people find themselves involved and the need to respond to these problems.

With regard to the management of this type of negative circumstances, the resilience approach has emerged, which aims to influence the understanding of and coping with these psychopathologies (Sibalde et al., 2020). Research on resilience began to show that many young people, despite the adverse situations that affected them, were invulnerable (Uriarte, 2006); in other words, they were resilient in the face of adverse situations and adapted to unfavourable realities. Thus, Luthar and Cushing (1999) defined resilience as a valid competence to cope positively and affectively with risk or adversity.

People who act resiliently strive to cope with the adversities they face, showing a clear spirit of self-improvement. According to this perspective, resilience is embedded in a particular social, cultural and family context and occurs at particular times in a person's life.

These findings led to an in-depth exploration of this resilience construct and proposals for its development. The capacity to adapt to new realities, coping positively with complex situations, the confidence with which decisions are faced and the active and protagonist role that each person assumes in the management of their life processes are characteristics of resilient behaviours, which favour progress in the course of each person's life, at each moment of maturity. Resilience is therefore a construct of an evolutionary nature, to be activated in dynamic situations or processes, in order to overcome complex situations or activities. But not all people are naturally resilient, so this competence must be promoted through training in the different scenarios and contexts in which each person grows, copes and develops. And one of the contexts in which the importance and usefulness of resilience has been seen is in academia. In general terms, educational resilience can be understood as the capacity of students to perform well, even when social, economic or family circumstances are not the most favourable. Martín (2013) refers to academic resilience as the ability of students to overcome adverse situations that threaten the possibilities of an adequate educational development.

It is therefore an ability to overcome adverse situations and move forward in the achievement of academic goals. The assumption of resilience as a capacity to cope on one's own with complex situations in school contexts undoubtedly has enormous potential in the education field, especially if it is contextualised in the current higher education training model. The focus in educational processes at the university is now on the students, who have to be autonomous and active, with the capacity to manage the search for information and construct their own learning (Student-Centred Teaching Model). Acknowledging this approach, resilience is a key factor to consider, as students with resilient skills will be less likely to fail or drop out of education.

The adaptation of students to university education is a very complex process, as reflected in the dropout rates reported every year. The change of stage, the application of new learning methodologies, the relationship with new people, facing new content, the pressure of assessment, having to manage tasks from different subjects, etc. means that for many students, their time at university is short-lived. For these reasons, academic dropout is nowadays one of the serious problems facing the university institution (Bethencourt et., 2008). Although a wide range of measures are being implemented, dropout rates are very high and exceed global expectations year after year (Álvarez and Cabrera, 2020).

It is especially during the first year of university studies that students assess their problems and ask themselves whether they will be able to continue their studies, in many cases dropping out because they cannot cope with the situation, which turns university faculties into revolving doors through which students pass in a fleeting manner (Bernardo et al., 2020). For various reasons, many students do not feel able to meet the challenge of university studies and feel demotivated and excluded and fail to complete their adaptation process. This lack of social and academic integration, the isolation that invades them, the lack of motivation due to their inability to keep up with the learning process, etc. leads them to the decision to give up the training they have started. Especially for students who do not have the resilience to cope with these adverse situations, the chances of coping are reduced and dropping out is experienced as a relief from the stress of the situation.

University students face many challenges related to their educational process and, as has been shown, these have a considerable impact on psychological, behavioural, health, academic and other aspects. In this sense, the study by Zárate-Depraect et al. (2018) showed how lack of study habits leads to high academic stress. Likewise, the work by Cara et al. (2021) evinced that poor lifestyle habits of university students (shortage of time, number of class hours, internships, etc.) give rise to academic stress that has a negative influence on study performance. It is therefore important that resilience is considered as a predictor of academic

adaptation and performance. The studies that have been carried out have revealed that those students with good resilience capacity and management not only avoid situations of academic failure or dropout, but also achieve good learning results, controlling all those factors such as anxiety, low self-esteem, stress or lack of social skills that in many cases determine dropout. Students who deal constructively with the challenges of the learning process and are not overcome by negative academic experiences tend to turn the situation around and achieve good learning outcomes. In this line, Gimeno-Tena and Esteve-Clavero (2021) consider that healthy habits help to achieve good academic results.

Students with low resilience tend to present low self-esteem, lack confidence in their abilities and have anxiety about academic activities, etc. All of this will influence their academic performance, as there is a direct relationship between learning and resilience, in some cases leading to dropping out of education. This justifies the need to propose measures throughout the education system and life that contribute to the acquisition and strengthening of resilient competences, which help learners to cope with these difficulties (Kuperminc et al., 2020). If resilience is worked upon as a component of the maturation process of students, as a cross-cutting content of teaching, a better emotional balance and integral development can be achieved.

Many models have been proposed to contribute to the development of resilient behaviours in schools. These include that of Henderson and Milstein (2005), who proposed the resilience wheel, a six-step scheme that contributes to building resilience in schools. However, it should be noted that building resilient environments through the work of teachers is not an easy task, due to the mediating effect of the context. As Belykh (2019) points out, what is really important would be for teachers to develop a proactive resilient attitude in relation to the context in which they operate. The work of educators (teachers, tutors) is very important in the configuration of scenarios that facilitate the development of resilient behaviours in students. We are talking about teachers who are clear about and play an active and motivating role in the development of resilience among their students (Segovia-Quesada et al., 2020).

METHOD

Objectives and hypothesis

The main purpose of this research was to analyse whether university students with low resilience were more likely to drop out of school. Thus, the working hypothesis underpinning this study was that students with low levels of resilience would have a greater intention to drop out.

Participants

The target population for this study was university students studying undergraduate courses associated with the education area at the University of La Laguna (ULL): Bachelor's Degree in Early Childhood Education, Bachelor's Degree in Primary Education and Bachelor's Degree in Pedagogy. During academic year 2021/2022, the period in which the information gathering process was carried out, a total of 2341 students were enrolled in these university degrees, according to data provided by the Analysis and Planning Office (GAP) of the ULL. Thus, to achieve a confidence level of 95% and a margin of error of ±5%, the final study population should be at least 331 students. In the particular case of this study, and by means of a non-random accidental sample selection procedure, a total of 412 (n=412) students participated, which placed the calculation of the sample representativeness at 96% confidence and a ±4.6% margin of error. The general characteristics of the sample participating in the study are shown in table 1.

Table 1
Participating sample characteristics

Age	Minimum=18 Maximum=51 $\bar{x}$=20.01 SD=3.45
Gender	Men=19.2% (n=79) Women=80.8% (n=333)
Qualification	Early Childhood Education Teaching Degree=19.9% (n=82) Primary Education Teaching Degree=42.7% (n=176) Degree in Pedagogy=37.4% (n=154)
Academic year	First=176 (60.5%) Second=115 (39.5%)

Data gathering instrument

For data collection, an ad hoc instrument designated the "Resilience and University Dropout Intention Questionnaire" was designed and constructed based on the Connor-Davidson Resilience Scale (CD-RISC) of Connor-Davidson (2003). This scale includes a total of 5 factors distributed in 25 Likert-type items (table 2). The reliability and validity results obtained (internal consistency, test-retest, convergent validity and discriminant validity) and the factor analysis carried out on the original scale present values accepted by the literature for use as a tool for measuring the resilience construct, which can be consulted in the work of Connor and Davidson (2003).

Table 2
Resilience scale items and coding

Factors	Items	Cod.
1. Personal competence, effort and tenacity	I work to achieve my goals, regardless of the difficulties I may encounter	r24
	I don't give up, even though things seem to have no solution	r12
	I think I can achieve my aims, even if there are obstacles	r11
	I'm proud of my achievements	r25
	I make an effort no matter what the outcome may be	r10
	I like challenges	r23
	I consider myself a strong person when faced with life challenges	r17
	I am not easily discouraged by failure	r16
2. Self-confidence and tolerance of difficulties	When faced with problems, I sometimes act intuitively (without knowing why)	r20
	If necessary, I can make difficult decisions that could affect other people	r18
	I prefer to try to solve things myself, rather than let others decide for me	r15
	When tackling problems, I tried to see their funny side	r6
	Facing hardship can make me stronger	r7
	I am able to handle unpleasant/painful feelings (e.g. sadness, fear, anger, etc.)	r19
	I stay focused and think clearly under pressure	r14

Factors	Items	Cod.
3. Positive acceptance of change	I am able to adapt when changes arise	r1
	I can cope with anything	r4
	Past successes give me the confidence to take on new challenges	r5
	I have at least one person I can count on if I am stressed out	r2
	I can recover soon after experiencing difficulties	r8
4. Self-monitoring of life development	I feel in control of my life	r22
	I know where to seek help during times of stress	r13
	I know my purpose in life	r21
5. Influence of luck or spiritual matters	When there is no clear solution to my problems, sometimes luck can help me	r3
	Good or bad, I think most things happen for a reason	r9

The questionnaire also included other questions on socio-demographic (age, gender), academic (university degree, academic year) and dropout (intention to drop out of studies and reasons for such intention) issues. This type of information was used, on the one hand, to describe the characteristics of the participant sample and, on the other, to assess the possible impact of resilience on the intention to drop out of university studies. The type of measures used in the questionnaire applied are presented in Table 3.

Table 3
Types of measures used in the questionnaire

Item	Measurement used
Age	Open
Gender	Dichotomous
University qualification	Multiple-choice
Academic year	Multiple-choice
Intention to drop out of university	Dichotomous
Reasons for dropping out of university	Open
Resilience scale	Likert -type scale (1-7*)

* Where 1 refers to the lowest score and 7 to the highest.

Prior to administration of the final questionnaire, the translation process of the items included in the original CD-RISC scale was carried out. Once this initial step was completed, an initial version of the questionnaire was defined and submitted, following McMillan and Schumacher's approach (2005) to different procedures for the construction of data gathering tools:

- First, an expert trial was held to assess, item by item, the comprehension, relevance and appropriateness of the questions included in the questionnaire. To this end, 3 people specialised in the field under study collaborated in the study (n=3).
- Second, 2 people linked to the educational research methodology area (n=2) carried out a form test analysing aspects such as the suitability of the questions to the objectives of the work, whether the items were properly defined for the analyses that were to be carried out., etc.

For both tests (expert and form), evaluators were provided with an instrument in which they rated the relevance, clarity and appropriateness of each item on a 7-level Likert scale (1 as the lowest rating and 7 as the highest). In addition, a comments section was included so that experts and specialists could provide their qualitative assessments of the proposed questionnaire.

The information from these tests served as a reference to incorporate modifications in the instrument that was finally applied. With regard to the reliability of the questionnaire used, the values of Cronbach's alpha coefficient (α) and McDonald's omega (ω) are shown in the results section of this paper.

Data gathering procedure

Once the final data collection instrument had been defined, the questionnaire designed for this purpose was applied. We decided to administer the questionnaire remotely in order to facilitate the data gathering procedure. To this end, the Google Forms tool was used, as the target population was ULL students who used Google for Education as their digital working ecosystem and were therefore familiar with this tool. To provide students with the link containing the data collection instrument, the teachers who taught them were contacted by e-mail to request their collaboration in administering the defined test, so that, in a short space of time (approximately 15 minutes), students could complete the questionnaire during class sessions. In this communication with the teaching staff, the aims of the work being carried out were explained and a document with the informed consent to be distributed to the students was attached. After this initial contact and during the months of March, April and May 2022, the process of administering the questionnaire was carried out.

Ethical questions and methodological rigour

Special attention was paid to ethical issues and methodological rigour in this study. To this end, different strategies were articulated. One of them was the drafting of a confidentiality document signed by the researchers in order to preserve the information derived from the study. Another was the construction of an informed consent form which was given to the students at the time of the test administration and which contained the objectives of the work, the summary of the study, the researchers responsible, the processing of the data obtained, and the results of the study, etc. In this consent form, the study's target population was also informed that the work was voluntary and anonymous. Finally, it should be noted that, at all times, the data derived from the work were submitted and processed in accordance with the provisions of Organic Law 3/2018, of 5 December, on the protection of personal data.

Analysis and interpretation of the results

Once the administration and data collection process was completed through the questionnaire, we proceeded to download the database automatically generated by the Google Forms application in CSV (comma separated values) format. Processing of the data and the statistical tests performed to meet the objectives of this study were carried out using R-Studio software (version 2022.07.1 build 554) and Microsoft Excel (Office 365 version), both for Microsoft Windows

10 operating environment. Specifically, these methodological support applications were used to perform calculations of central tendency and frequencies, assess the data distribution (kurtosis, skewness, Shapiro Wilk and Kolmogorov-Smirnov [K-S]), perform contrast analysis using non-parametric tests (Mann-Whitney U) and run tests to measure the reliability of the resilience scale used (Cronbach's alpha coefficient [α] and MacDonald's omega [ω]).To complete the contrast analyses carried out, the effect size was quantified using the probability of superiority test (PSest), using the following mathematical expression (Erceg-Hurn and Mirosevich, 2008):

$$Ps_{est} = \frac{U}{m.n}$$

The α value for the analyses performed in this paper was .05. On the other hand, for the open-ended question included in the survey, a content analysis was carried out and the answers were coded with the acronym pN (where p refers to the word participant and N to the number of the study subject).

RESULTS

Database debugging and prior analyses

Prior to conducting the statistical tests to meet the objectives set in this study, a process of data cleaning and preliminary analysis was carried out to determine the type of contrast tests to be performed Initially, it was verified that the information imputed in the database automatically generated from the Google Forms tool was within the expected range for each of the items in the questionnaire. The presence of possible multivariate outliers was then determined. For this purpose, the Mahalanobis distance was calculated, which, according to Muñoz and Amón (2013), yields a value from which subjects are identified as extreme because they are located considerably far from the centre of the mass. In the particular case of this study, this distance obtained a value of 58.12, which made it possible to recognise a total of 74 atypical cases, placing the definitive study sample at 338 students (n=338).

Another aspect that was reviewed in this data cleaning process was multicollinearity. This was done to assess the possible redundancy of the items included in the CD-RISC scale used. This procedure was carried out by means of a calculation of bivariate item-to-item correlations, the values of which, for the total number of cases, was ≤.≤.85. These values, following the proposals of Holgado et

al. (2019), confirmed that the items were sufficiently discriminating between each other.

Given the nature of the aims of this study, different tests were performed with the intention of analysing the data distribution, as this would determine the type of contrast analysis to be performed (parametric or non-parametric). Specifically, this process was performed using skewness and kurtosis analysis and the Shapiro Wilks and Kolmogorov-Smirnov (KS) tests, with values at p<.000. Thus, in line with George and Mallery (2011), the data obtained in the study did not follow a normal distribution.

Finally, the reliability of the resilience scale used was calculated through the Cronbach's alpha (α) and McDonald's omega coefficients. The first of these procedures should be carried out when the assumptions of tau-equivalence, unidimensionality and continuity of measurement are met (Raykov and Marcoulides, 2017). The second of the coefficients is appropriate due to its greater robustness in studies linked to the field of social sciences (Viladrich et al., 2017). For both cases, the values obtained exceeded the critical scores proposed by the literature (Taber, 2018): α=.95; ω=.96.

Table 4 presents the reliability values of the factors analysed.

Table 4

Descriptive analysis of the resilience scale

Factor	Cronbach's alpha (α)	MacDonald's omega (ω)
1	.92	.94
2	.84	.86
3	.84	.87
4	.79	.81
5	.47	.49

Dropout intention among university students

The results of the work carried out showed that 30.9% (n=104) of the students surveyed expressed their intention to drop out of university studies. The answers to the open question included in the questionnaire revealed the main reasons given by students as an explanation for their possible dropping out of university studies. The first reason was related to the excessive study workload. Some students, for example, said they felt "overwhelmed" (p3). Another of the main reasons for the intention to abandon their university studies was linked to the lack of vocation for the training they were undertaking, stating that "I like the degree, but I don't see myself working as a teacher (p119)" or "for believing that it's not really what I like" (p264). Related to this were also the students who were taking these university studies "as I could not get into my first choice" (p88). In addition, the dissatisfaction with the teaching methodology used in the degree course was notable. In this sense, one of the students stated that the classes are "monotonous, and they do not reflect the real profession of a teacher [...], with an evaluation that moves away from continuous assessment" (p337). Lastly, personal problems or circumstances that in one way or another contributed to the idea of dropping out of school were cited. In fact, students reported "family problems" (p233) and financial difficulties that "have led me to consider giving up my studies in order to work" (p198).

Levels of resilience and intention to drop out of university studies

The average level of resilience obtained was 5.15 ($\bar{x}$ =5.15; sd=.97). More specifically (table 5), it is worth noting that students indicated that they had people close to them who offered support in times of stressful situations ($\bar{x}$ =6.08; sd=1.266), were proud of their successes and academic achievements ($\bar{x}$ =5.98; sd=1.263) and solved the problems and difficulties by themselves ($\bar{x}$ =5.74; sd=1.220). In contrast, students scored lower on feeling discouraged when faced with possible situations of failure ($\bar{x}$ =4.55; sd=1.529), when taking difficult decisions affecting other people ($\bar{x}$ =4.55; sd=1.573) or believing in luck as a means of help when they did not find solutions to their problems ($\bar{x}$ =4.14; sd=1.579).

Table 5
Descriptive analysis of the resilience scale

Factor	Item	$\bar{x}$	sd
1	r24	5.55	1.262
	r12	5.34	1.350
	r11	5.60	1.262
	r25	5.98	1.263
	r10	5.37	1.417
	r23	4.84	1.547
	r17	5.16	1.379
	r16	4.55	1.529
2	r20	4.89	1.420
	r18	4.55	1.573
	r15	5.74	1.220
	r6	4.77	1.597
	r7	5.61	1.170
	r19	4.71	1.609
	r14	4.69	1.541
3	r1	5.35	1.127
	r4	4.99	1.364
	r5	5.49	1.376
	r2	6.08	1.266
	r8	4.82	1.411
4	r22	4.69	1.596
	r13	5.29	1.498
	r21	5.10	1.609
5	r3	4.14	1.579
	r9	5.57	1.483

In general terms, the contrast analyses carried out showed that students with a higher level of resilience were those with the lowest intention to drop out (U=7634.500; R=188.23; p<.000; PS_{est}=.31). Regarding the first of the factors included in the CD-RISC scale (table 6), the group of students who suggested the possibility of giving up the studies they had started were those who stated that they least liked the educational challenges (U=9641.000; R=145.20; p=.002; PS_{est}=.39), that they were less proud of their academic achievements(U=9538.500; R=144.22; p=.001; PS_{est}=.39) and saw themselves as having less capacity to tackle life challenges (U=9387.000; R=142.76; p=.001; PS_{est}=.38).

Table 6
Factor 1 contrast analysis

Item	Dropout intention	Average range	U	p	PS_{est}
r24	No	186.00	8155.500	.000	.33
	Yes	130.92			
r12	No	186.85	7957.000	.000	.32
	Yes	129.01			
r11	No	182.53	8963.500	.000	.36
	Yes	138.69			
r25	No	180.06	9538.500	.001	.39
	Yes	144.22			
r10	No	181.57	9187.500	.000	.37
	Yes	140.84			
r23	No	179.62	9641.000	.002	.39
	Yes	145.20			
r17	No	180.71	9387.000	.001	.38
	Yes	142.76			
r16	No	184.04	8611.000	.000	.35
	Yes	135.30			

With regard to the second factor (table 7), statistically significant differences were also identified between students with and without intention to drop out of university studies. Thus, students who thought at some point about dropping out of academic training were characterised by delegating the decision of their problems to other people (U=10524.000; R=153.69; p=.045; PS_{est}=.43), by not understanding that difficulties can serve as a starting point to become stronger (U=10102.500; R=149.64; p=.013; PS_{est}=.41) and by having few coping skills to handle unpleasant feelings like sadness, anger, etc. (U=9382.000; R=142.71; p=.001; PS_{est}=.38).

Table 7
Factor 2 contrast analysis

Ítems	Dropout intention	Average range	U	p	PS_{est}
r20	No	171.77	11469.500	.423	
	Yes	162.78			
r18	No	173.69	11022.500	.178	
	Yes	158.49			
r15	No	175.83	10524.000	.045	.43
	Sí	153.69			
r6	No	177.64	10102.500	.013	.41
	Yes	149.64			
r7	No	181.13	9290.000	.000	.38
	Yes	141.83			
r19	No	180.73	9382.000	.001	.38
	Yes	142.71			
r14	No	182.10	9064.500	.000	.37
	Yes	139.66			

Another aspect measured in the applied resilience scale was positive acceptance of change (table 8). As in the previous cases, the Mann Whitney U-test confirmed the existence of statistical differences between the two groups studied. Generally, those who scored lower on this third factor were students who at some point in their educational pathway expressed the possibility of not continuing their studies. This was due, among other issues, to the fact that they were people who had greater difficulties in adapting to change (U=9580.000; R=144.62; p=.001; PS_{est}=.39) and lack of self-confidence (U=9156.000; R=140.54; p< .000 PS_{est}=.37).

Table 8
Factor 3 contrast analysis

Ítems	Dropout intention	Average range	U	p	PS_{est}
r1	No	179.88	9580.000	.001	.39
	Yes	144.62			
r4	No	182.59	8950.500	.000	.36
	Yes	138.56			
r5	No	181.70	9156.000	.000	.37
	Yes	140.54			
r2	No	178.65	9868.000	.003	.40
	Yes	147.38			
r8	No	184.74	8449.500	.000	.34
	Yes	133.75			

The fourth of the factors analysed (table 9) also showed inequalities, with the group of students who intended to abandon their university studies being those who scored the lowest in the set of items proposed. Specifically, these students indicated that they found it difficult to seek help when they had difficulties (U=8598.000; R=135.17; p<.000; PS_{est}=.35). Furthermore, they stated that they were not clear about their purpose in life (U=7847.500; R=127.96; p<.000; PS_{est}=.32) and that they did not have adequate control over their life development (U=7814.500; R=127.64; p<.000; PS_{est}=.32).

Table 9
Factor 4 contrast analysis

Ítems	Dropout intention	Average range	U	p	PS_{est}
r22	No	187.32	7847.500	.000	.32
	Yes	127.96			
r13	No	187.46	7814.500	.000	.32
	Yes	127.64			
r21	No	184.10	8598.000	.000	.35
	Yes	135.17			

For the last of the factors included in the CD-RISC scale (table 10) it was found that the students who indicated that they intended to drop out of university studies were those who considered that life milestones occurred for some random reason (U=9516.000; R=144.00; p=.001; PS_{est}=.39).

Table 10
Factor 5 contrast analysis

Ítems	Dropout intention	Average range	U	p	PS_{est}
r3	No	172.49	11302.000	.316	
	Yes	161.17			
r9	No	180.16	9516.000	.001	.39
	Yes	144.00			

For all the differences found, the effect size, according to the interpretative scores proposed by Erceg-Hurn and Mirosevich (2008), was small.

DISCUSSION AND CONCLUSIONS

The aim of this research was to analysing the relationship between resilient behaviours and intention to drop out in undergraduate university students. Analyses showed that students with the highest level of resilience had the lowest intention to drop out of school. In light of these results, there is no doubt that there is a close connection between these two factors, as the most resilient students did not consider dropping out of school, which is consistent with the findings of other studies, such as Morgan (2021), who found that the most resilient students performed better academically.

And in a context of crisis such as the one we have undergone and are still experiencing as a result of the health pandemic, it is necessary to evaluate and promote the development of students' resilience to face complex situations. We agree with Jiménez (2022) that the reality that has been experienced in university education, which forced a drastic change from face-to-face to virtual teaching and the hasty assimilation of many unexpected changes, caused many students to lose control of their training process, as the situation generated high levels of stress that many were unable to manage.

To this end, university centres should implement preventive initiatives that promote skills for adapting to different situations and serve as a barrier to the serious problem of academic dropout. Because, as noted by Uriarte (2006, p.20), the "school must react to the high level of school failure and pupils at risk of maladjustment and exclusion". And one of the most effective strategies that have been used in recent times to support students in their autonomous learning process and reduce the risk of dropping out is university tutoring, which, as López-Martín and González (2018) point out, must be based on communication, close personal relationships, respect and privacy. In this attempt to prevent situations of maladjustment and dropping out of studies, Esteban *et al.* (2016) stated that the type of relationship students have with their tutoring staff has a decisive influence on their decision to stay at university and strive to achieve their academic goals. Undoubtedly, through university tutorial plans it is possible to advise and promote resilient behaviour in students, so that they toughen up in the face of adverse situations (accumulation of academic tasks at specific times of the course, mental exhaustion at assessment times, management of poor academic results, difficulties in communication with teachers, handling conflicts with classmates in group work, etc.). In the study carried out by Cotán (2021), it was concluded that a favourable classroom climate and the good relations maintained with classmates and teaching staff successfully marked university educational trajectories.

For all these reasons, in this research we position ourselves in a concept of resilience of a formative, proactive, competent and dynamic nature, which seeks

the strength and evolution of the person, based on perseverance, persistence and personal commitment. It is, in short, an attitude of life, assuming that at certain times each person must overcome adverse situations of stress, pressure, anxiety, restlessness, uncertainty, etc., without this weighing down and conditioning the possibilities of development.

Knowing how to assume and face these critical situations in academic contexts is a condition for growing, maturing and achieving the goals that each of us sets for ourselves. Higher education calls for students who are motivated towards effort, adaptable to change, with conflict resolution skills; strong, resilient learners. Because otherwise people who are not able to cope with adverse situations are very likely to fail. It was demonstrated in this research: participants who at some point in their training process considered abandoning their studies showed low resilience behaviours, such as delegating responsibility for decisions to others, inability to manage states of sadness, having little control over their life project, finding it difficult to adapt to changes or feeling a lack of self-confidence. The negative influence of all these variables on performance is evident, since, as Adell (2006) points out, motivational, attitudinal and personality factors condition academic outcomes. According to this author, variables predictive of academic performance include confidence, aspirations, valuation of intellectual work, group integration, classroom climate, participation, dedication, learning achievement, and so on. The value of resilience in coping with challenging situations is evident and Villalta *et al.* (2017) highlighted the importance of commitment, positive self-image, readiness for action, optimistic view of the future or confidence in one's own abilities for academic achievement.

If we think of students who meet these conditions, the chances of them coping satisfactorily with negative situations that may arise in the course of their training increase considerably. In this study carried out by Castaño *et al.* (2006), resourcefulness was the resilience factor with the strongest influence on academic achievement. Research by Lora-Loza (2020) also showed a positive correlation between extrinsic motivation and academic performance. In others, such as that by Sánchez-García *et al.* (2018), it was observed that university students with emotional disturbances showed poor performance in their studies. Finally, the research by Espinosa-Castro (2020) confirmed that stress and low resilience affected academic performance.

As a general conclusion of the research, resilience is significantly associated with intention to drop out, as it was the students who showed a lack of confidence who were unable to take control of their own projects. Similarly, those who delegated their responsibilities to others were those who at some point had considered leaving university education. The results coincide with those of other studies, such as that of Navarro *et al.* (2020), who also found stress-generating academic situations,

such as work overload, dissatisfaction with teaching work, difficulties in adapting to changes, the stress of classes or the pressure of assessment.

The results obtained in this research should be taken into consideration and programmes and activities that foster leadership, motivation, academic commitment, self-regulation, confidence, planning, responsibility and the ability to adapt to complex situations should be implemented in universities. In this way, personal growth and the construction of consistent educational and professional projects throughout life will be strengthened. These achievements will be possible if schools are also equipped with good professionals, teachers and tutors who practise resilient behaviour. Because making resilient students requires teachers who develop empathy and positive thinking in their classes and who put skills into practice that allow them to modify negative attitudes in their students As Day and Gu (2015) point out, building resilient learners is about having school leaders, resilient teachers for resilient schools. In this line, the work of Olmo-Extremera *et al.* (2021) is notable, emphasising the importance of building resilience in schools through leadership action, in order to strengthen relational trust, professional collaboration and mutual support, etc., which will undoubtedly lead to the development of better-quality teaching.

Although the work confirms the relationship between resilience and intention to drop out of school, the results should be interpreted with a number of limitations in mind. In principle, and despite the fact that the levels of sample representativeness of the work carried out meet statistical standards, the findings cannot be transferred to all degree programmes or to other universities, given that the realities and contexts could be different. This leads to the need to carry out work that allows for a more in-depth study of the link between the variables studied in order to generalise the results obtained. In addition to the research initiated, the challenge is to carry out studies based on longitudinal methodological designs to analyse how thinking about dropping out of university studies is constructed. Finally, it would also be interesting to carry out work of a qualitative nature, as this will allow us to delve deeper into the reality of this problem from the students' point of view.

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Flexible and rigid persistence: Relations with passion, vitality, and intention to stay in university teachers

Persistencia flexible y rígida: relación con pasión, vitalidad e intención de permanecer del profesorado universitario

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ABSTRACT

Passion and persistence are related constructs that have been perceived as key qualities for people to achieve their aims. While passion has been widely analyzed from a dualistic position, studies on persistence have rarely been focused on persistence regarding its quality. Thus, the aim of this study was twofold. Firstly, it aimed to analyze the relationships between flexible and rigid persistence, harmonious and obsessive passion, subjective vitality, and intention to stay in a sample of 201 university teachers from 20 universities. The secondary

goal was to translate and assess the psychometric properties of the Spanish version of the Flexible and Rigid Persistence Scale. Overall, the findings supported the hypotheses tested. Regarding the first aim, we tested a structural equation model in which we hypothesized that harmonious passion would positively lead to flexible persistence and, to a lesser degree, to rigid persistence, and that obsessive passion would positively predict rigid persistence and negatively predict flexible persistence. In turn, both types of persistence would predict intention to continue teaching (activity outcome), but only flexible persistence would predict subjective vitality (life outcome). As expected, the structural equation model showed that harmonious passion for teaching predicted flexible persistence, while obsessive passion for teaching predicted rigid persistence and it was negatively related to flexible persistence. In turn, only flexible persistence predicted subjective vitality and intention to keep on teaching. Regarding the second goal of the study, results from exploratory structural equation modeling, reliability analysis, and multi-group exploratory structural equation modeling supported the psychometric properties of the Spanish version of the scale in the educational context for university teachers. These results are partially consistent with those reported in the original version, and they lead to new research on the role of passion and persistence in education.

Keywords: passion, persistence, university teachers, intention to stay, subjective vitality

RESUMEN

La pasión y la persistencia son constructos relacionados que se consideran relevantes para la consecución de objetivos. Aunque la pasión ha sido ampliamente analizada desde una perspectiva dualista, pocos estudios sobre persistencia han analizado este constructo atendiendo a su calidad. Este estudio tuvo dos objetivos. El primer objetivo fue analizar la relación entre la persistencia flexible y rígida, la pasión armoniosa y obsesiva, la vitalidad subjetiva y la intención de seguir enseñando en 201 docentes universitarios. El segundo objetivo fue evaluar las propiedades psicométricas de la versión española de la escala de Persistencia Flexible y Rígida. Con relación al primer objetivo, se evaluó un modelo de ecuaciones estructurales en el que se hipotetizó que la pasión armoniosa predecía la persistencia flexible y, en menor medida, la persistencia rígida, así como la pasión obsesiva predecía la persistencia rígida y negativamente la persistencia flexible. A su vez, ambos tipos de pasión podrían conducir a la intención de permanecer, pero únicamente la persistencia flexible estaría relacionada con vitalidad subjetiva. Como era de esperar, el modelo de ecuaciones estructurales mostró que la pasión armoniosa hacia la enseñanza predice la persistencia flexible, mientras la pasión obsesiva predice la persistencia rígida y está negativamente relacionada con la persistencia flexible. A su vez, únicamente la persistencia flexible predice la vitalidad subjetiva y la intención de continuar con la docencia. En cuanto al segundo objetivo, los resultados del modelo exploratorio de ecuaciones estructurales, análisis de fiabilidad y el modelo exploratorio multigrupo de ecuaciones estructurales permiten confirmar las propiedades psicométricas de la versión española de la escala en el contexto educativo. Estos resultados fueron parcialmente consistentes con los obtenidos en

la versión original y abren una nueva línea de investigación sobre el papel de la pasión y la persistencia en el contexto educativo.

Palabras clave: pasión, persistencia, profesorado universitario, intención de continuar, vitalidad subjetiva

INTRODUCCIÓN

Passion and persistence are related constructs that have often been perceived as essential qualities for people to achieve their long-term aims (Hatch & Garcia, 2017; Vallerand et al., 1997, 2003). Indeed, both concepts have been widely related to positive outcomes, not only in the educational context (e.g., Bonneville-Roussy et al., 2011; Schneider & Preckel, 2017; Vallerand et al., 2007), but also as pertains to people's lives in general (e.g., Carpentier et al., 2012; Chichekian & Vallerand, 2022; Ho et al., 2018; St-Louis et al., 2016). In addition, several studies have analyzed the relationship between passion and persistence, usually placing the former as a predictor of the latter (e.g., Bonneville-Roussy et al., 2013; Cardon & Kirk, 2015; Feng & Chen, 2020; Vallerand et al., 2003).

Although the literature on passion mainly consists of research conducted under the Dualistic Model of Passion (Vallerand et al., 2003) and the existence of two types of passion —harmonious and obsessive— is widely accepted, studies on persistence have rarely been focused on persistence regarding its quality. As a consequence, studies have not analyzed the persistence construct from a dualistic position. In other words, little research has been conducted on the different types of persistence that may exist and how they may prompt different outcomes. Consequently, Chichekian and Vallerand (2022) have recently introduced a new perspective, proposing the existence of two types of persistence, namely flexible and rigid, that vary in quality. In that study, Chichekian and Vallerand validated a scale to measure the construct and the outcomes supported the existence of two types of persistence, both predicted by the different types of passion and leading to different outcomes. The Flexible and Rigid Persistence Scale has been shown to be a valid and reliable instrument to assess both types of persistence in education with students (see Chichekian & Vallerand, 2022; Vallerand et al., 2022), and there is no Spanish version available. Thus, the main aim of this study was to analyze the relationships between flexible and rigid persistence, harmonious and obsessive passion, and adaptive university teacher outcomes. The secondary aim was to translate the scale into Spanish and to assess its psychometric properties.

On the concept of persistence

Most of the research on persistence highlights its relevance in helping people achieve long-term objectives (Chichekian & Vallerand, 2022). Persistence has been broadly defined as a stable commitment toward a goal, as well as a willingness to maintain a permanent effort to achieve a specific aim regardless of the hardship, obstacles or fear involved (e.g., Gimeno et al., 1997; Schmidt et al., 2017). In recent years, a growing body of literature involving persistence has mainly been carried out under the construct of grit, which is defined as the "perseverance and passion for long-term goals" (Duckworth et al., 2007). In this regard, grit generally describes the capacity to commit and persevere thought adversity (Robertson-Kraft & Duckworth, 2014; Stoffel & Cain, 2018), and most evidence suggests that it involves a combination of two components: "perseverance of effort" and "consistency of interest over time" (see Credé et al., 2016; Stoffel & Cain, 2018). Specifically, the perseverance component refers to the tendency to work hard despite hardship, and the consistency component denotes the maintenance of long-term interests and goals.

To date, numerous studies have widely evidenced that the greater the persistence, the more the academic achievement, deliberate practice or effectiveness (e.g. Duckworth et al., 2011; Robertson-Kraft & Duckworth, 2014; Schneider & Preckel, 2017; Strayhorn, 2014). However, the majority of this literature, i.e. those works including grit, has only focused on intensity as the main trait of persistence, essentially showing that people who present a high degree of persistence are more likely to achieve a goal or to display better outcomes (Chichekian & Vallerand, 2022). In this sense, previous studies have mainly focused on the intensity of persistence, but far fewer research works have considered the quality part of the construct. Perhaps bearing in mind the quality part of persistence could explain why some studies, especially in the academic context (see Credé et al., 2016), have not found positive relations between persistence and success.

As seen above, Chichekian and Vallerand (2022) proposed the existence of qualitative differences regarding how people persist toward a given goal or purpose. Although qualitative differences on persistence have been noted before by other authors (e.g. Brandtstädter, 2009; Wrosch et al., 2003), they were mainly focused on different ways to persist through modification of the original goal or even abandoning it if necessary. However, the view posited by Chichekian and Vallerand (2022) highlights that persistence may also vary in terms of quality while pursuing a given goal, and that two types of persistence may exist depending on the type of passion underlying them.

On persistence and the Dualistic Model of Passion

Passion for an activity has been widely associated with persistence (e.g., Bonneville-Roussy et al., 2013; Cardon & Kirk, 2015; Feng & Chen, 2020; Vallerand et al., 2003), the literature generally supporting that the more passion, the more persistence toward an activity. In the Dualistic Model of Passion (Vallerand et al., 2003), passion is defined as a strong inclination toward a self-defining activity that one likes or even loves, finds important, and in which someone invests a significant amount of time and energy". Based on this model, Vallerand et al. (2003) proposed the existence of two types of passion, harmonious and obsessive, each type associated with different outcomes and processes to internalize the activity into the person's identity. In detail, the harmonious passion comes from an autonomous internalization of the activity that leads people to freely engage in it. When engaged in the activity with this type of passion, people feel that the activity they love is consistent with their values and that it is in harmony with the other aspects or activities of their life (Bouizegarene et al., 2017; Vallerand et al., 2003). On the contrary, obsessive passion comes from a controlled internalization of the activity into the person's identity, and people engage in the activity that they love in part because of external or internal contingencies (e.g.: social acceptance or feelings of self-esteem). Moreover, with obsessive passion people tend to feel an uncontrollable urge to engage in the beloved activity, and they experience conflicts between the activity they love and other elements of their lives (Vallerand, 2015; Vallerand et al., 2003). Hence, people with obsessive passion usually ruminate about their passionate activity when they are not engaged in it (Vallerand, 2015, p. 79).

In view of the above, it is to be expected that harmonious and obsessive passion may lead to different outcomes, both while doing the passionate activity and also in other areas of people's lives. Research has indeed shown that harmonious passion leads to adaptive outcomes, such as flow (Vallerand et al., 2003), high levels of concentration (Mageau et al., 2005) or well-being (Bonneville-Roussy et al., 2011, 2013; Vallerand et al., 2007). Conversely, obsessive passion is associated with fewer adaptive outcomes, such as difficulties in maintaining concentration (Vallerand et al., 2015, p. 65), defensiveness (Donahue et al., 2009; Lafrenière et al., 2011) or anxiety (Rousseau & Vallerand, 2003). Consequently, it would be also expected that persistence, as a passion's outcome, could be affected not only in terms of intensity (e.g., Cardon & Kirk, 2015; Feng & Chen, 2020), but also in terms of quality depending on the type of passion underlying it (Chichekian & Vallerand, 2022).

In light of the above, Chichekian and Vallerand (2022) conducted the first research to empirically evidence the existence of the two types of persistence, flexible and rigid, how they are predicted by harmonious and obsessive passion, and how they

lead to different activity and life outcomes. According to Chichekian and Vallerand (2022), because flexible persistence is underpinned by harmonious passion, it allows people to persist toward the passionate activity with an open focus and to attend to other life goals. Thus, people can fully persist toward the passionate activity experiencing adaptive outcomes inside and outside the activity, and so have a more successful life. Conversely, because obsessive passion leads to rigid persistence and obsessively passionate people experience conflicts between the passionate activity and other areas in their life (Vallerand et al., 2003), rigid persistence is not expected to be related to positive outcomes outside the activity (Chichekian & Vallerand, 2022). In two studies with students, Chichekian and Vallerand (2022) validated a two-factor scale to assess both flexible and rigid persistence toward one's studies. In addition, the authors also evidenced that flexible persistence was positively predicted by harmonious passion and negatively predicted by obsessive passion. Furthermore, rigid persistence was mainly predicted by obsessive passion and, to a lesser degree, by harmonious passion. In turn, both types of persistence were related to the achievement of the activity goals and to adaptive outcomes while engaging in the activity one is passionate about. However, only harmonious passion predicted positive life outcomes, such as life vitality, outside the activity.

The present research

The main goal of this study was to test the relationships between flexible and rigid persistence, harmonious and obsessive passion, and adaptive teacher outcomes inside and outside the activity of teaching. We conducted a structural equation modeling (SEM) involving passion, persistence, and two types of outcomes, namely activity and life outcomes. Overall, it was hypothesized that the presence of the two types of persistence, flexible and rigid, would be uncovered and they would be uniquely related to harmonious and obsessive passion as predicted, and would predict activity and life outcomes as in the Chichekian and Vallerand (2022) study. Second, due to the absence of an instrument in Spanish to measure flexible and rigid persistence, the secondary goal of this research was to translate and analyze the psychometric properties of the Spanish version of the "Flexible and Rigid Persistence Scale" (Chichekian & Vallerand, 2022; Vallerand et al., 2022). However, whereas students served as participants in the Chichekian and Vallerand (2022) studies, in the present study, teachers were used as participants. For this purpose, we analyzed the evidence of construct validity by conducting a confirmatory factor analysis (CFA), reliability by assessing the internal consistency of the scale, and the scale invariance across sex by conducting a multi-group Exploratory Structural Equation Modeling (ESEM).

METHOD

This study is based on a quantitative cross-sectional methodological design.

Participants

A total of 201 teachers (56.2% women, 43.8% men) from 20 public universities in Spain took part in the study. Age range was between 26 and 71 years, mean age 52.19 years (*SD* = 9.5 years). Participants had been working as university teachers on average for 16.54 years (*SD* = 10.00 years); 85.6% were full-time teachers and 14.4% were part-time. Participants teach in-person. Information regarding the programs that teachers taught was not required. The non-probabilistic criterion of purposive convenience sampling was used to recruit participants.

Procedure

Questionnaires were administered by an online platform. We contacted the administrative staff from faculties and universities and asked them to distribute an e-mail with the online questionnaire to teachers. Questionnaires were also distributed through social networks and colleagues from different universities. To diminish the possible effect of social desirability, participants were informed about the data confidentiality and that their participation was strictly voluntary. Participants were also informed of the instructions for the proper completion of the questionnaire, and they were requested to respond as honestly as possible. In case of doubts, participants could contact a researcher via an email provided in the questionnaire. Although there was no limit to completing the questionnaire, the estimated average to complete them was about 10 minutes. The research was conducted in accordance with the ethical guidelines of the Declaration of Helsinki.

Instruments

Participants completed an online questionnaire with demographic questions and measures of persistence, passion, vitality, and intention to stay. Participants were asked to complete the scales based on their agreement with the statements. Scales were rated on a 7-point Likert-type scale ranging from 1 (*I do not agree at all*) to 7 (*I strongly agree*).

Persistence: To measure persistence we used Vallerand et al. (2022) 8-item Flexible and Rigid Persistence Scale. The scale has two subscales of four items each

to assess flexible persistence (e.g.: 'I work hard at my work goals, but other things matter as well') and rigid persistence (e.g.: 'I am willing to do anything to reach the top at work'). Following Muñiz et al. (2013; see also Vallerand, 1989) we first translated the scale into Spanish. Then, bilingual researchers back-translated the items into English, comparing them and checking the equivalence of meaning of the original and retranslated version. Researchers were recruited based on their bilingual content expertise, knowledge of assessment principles, and experience in the content of the test. We performed a qualitative pilot study (Muñiz & Fonseca, 2019) in which seven participants with similar characteristics to the final sample completed the scale and discussed about different aspects. All participants considered the scale easy to understand, any semantic or grammatical inconsistency was detected and it was estimated around ten minutes to complete the scale. The psychometric properties of the scale are presented in the results section.

Passion: We used 12 items from the Spanish version (Chamarro et al., 2015) of the Passion Scale (Marsh et al., 2013; Vallerand et al., 2003). This scale consists of two subscales to assess Harmonious Passion (e.g. 'This activity is in harmony with the other activities in my life') and Obsessive Passion (e.g. 'I have difficulties controlling my urge to do my activity'). McDonald's Omega was .89 for Harmonious Passion and .82 for Obsessive Passion. McDonald's Omega for the whole scale was .92.

Subjective vitality: We used seven items (e.g. 'I feel full of energy') from the Spanish version (Balaguer et al., 2005) of the Subject Vitality Scale (Ryan & Frederick, 1997). McDonald's Omega was .94.

Intention to stay: We reverted the scores of the scale developed by Gálvez (2006). This scale consists of four items (e.g. 'I have had a desire to leave the profession', reverse scoring) used to measure people's intention to remain in the organization in which they currently work. McDonald's Omega was .74.

Preliminary analyses

Statistical analyses were carried out using SPSS 24 and Mplus 8.3. To determine the evidence of construct validity of the Spanish version of the Flexible and Rigid Persistence Scale we conducted an Exploratory Structural Equation Modeling (ESEM). To examine the scale reliability, we used Average Variance Extracted (AVE), Composite Reliability (CR), and McDonald's Omega (1999). This index has shown better accuracy than Cronbach's Alpha (McNeish, 2017; Revelle & Zinbarg, 2009), and it does not require data to be continuous (Bonanomi et al., 2015) or factor loadings to be equal for all items (Zhang & Yuan, 2016). Following the two-step procedure proposed by Anderson and Gerbing (1988) we first analyzed the measurement model, which provides information about construct validity to the

instruments. For the ESEM we used CFI, TLI and RMSEA as fit indexes. The model fits well when CFI and TLI > .90, and RMSEA ≤ .05. We examined the scale invariance across sex using multi-group Exploratory Structural Equation Modeling (ESEM). This approach differs from CFA in that all factor loadings are estimated, and all cross-loadings are not constrained to be zero (Asparouhov & Muthén, 2009).

Main analysis

We performed a structural equation analysis (SEM) in which we hypothesized that the two types of passion would lead to the two types of persistence. Specifically, we hypothesized that harmonious passion would positively predict flexible persistence and negatively predict rigid persistence, whereas obsessive passion would positively predict rigid persistence and negatively predict flexible persistence. In turn, we hypothesized that both types of persistence would predict intention to stay (activity outcome), but only flexible persistence would predict subjective vitality (life outcome). We used CFI, TLI, and RMSEA as fit indexes. The model fits well when CFI and TLI > .90, and RMSEA ≤ .05. Regarding the estimation method, we used the Weighted Least Squares Means and Variance Adjusted (WLSMV), which is more accurate than the Maximum Likelihood Method when assessing ordered-categorical variables (Schmitt, 2011), provides robust estimates under small sample size bias (Byrne, 2012), and is robust to violations of the assumption of normality (Flora & Curran, 2004). We handled missing data using the WLS estimation method (Asparouhov & Muthén, 2010). To complete our model, we test the mediational effect of persistence following the recommendations of Hayes (2018). We computed the indirect effects and standard errors using the delta method (Sobel, 1982).

RESULTS

Preliminary results

Descriptive statistics (means and standard deviations) of the Flexible and Rigid Persistence Scale items are shown in Table 1.

Table 1
Descriptive statistics of all the items

Item	M	SD
Flexible persistence		
1. I work hard at my work goals, but other things matter as well.	6.25	.92
2. I work hard to achieve a work goal, but can stop if necessary.	5.31	1.45
3. I really focus on my work when it's time to do it.	6.30	.93
4. I try to reach my work goals but not at the expense of other life goals.	5.12	1.63
Rigid persistence		
5. I am willing to do anything to reach the top at work.	2.89	1.74
6. When it comes to reaching my goals at work, nothing else matters.	2.59	1.60
7. It is OK for me to focus only on work goals in order to succeed.	2.863	1.73
8. I am willing to let go of some things in life in order to excel at work.	2.889	1.72

Note. See the Appendix for the Spanish version of the items.

To determine the evidence of construct validity, we used an ESEM to assess the factor structure of the scale. The scale included two latent variables: flexible persistence and rigid persistence. The results of the ESEM indicated a good fit index: (200. 13) = 33.741 (p = .001), RMSEA = .090, CFI = .98, TLI = .96, and SRMR = .02. The factor loadings of the items (Table 2) ranged from .537 (item 3) to .960 (item 6), and all of them were significant (p < .01).

Table 2
Factor loadings for each item

Item	Factor Loadings	
Flexible persistence	Factor 1	
1. I work hard at my work goals, but other things matter as well.	.697	
2. I work hard to achieve a work goal, but can stop if necessary.	.828	
3. I really focus on my work when it's time to do it.	.537	
4. I try to reach my work goals but not at the expense of other life goals.	.568	
Rigid persistence		Factor 2
5. I am willing to do anything to reach the top at work.		.799
6. When it comes to reaching my goals at work, nothing else matters.		.960
7. It is OK for me to focus only on work goals in order to succeed.		.717
8. I am willing to let go of some things in life in order to excel at work.		.633

To analyze the internal consistency of the Flexible and Rigid Persistence Scale, we used McDonald's Omega (1999), Average Variance Extracted (AVE), and Composite Reliability (CR) McDonald's Omega values of each subscale were .74 for Flexible Persistence, and .85 for Rigid Persistence, AVE was .44 for Flexible Persistence and .62 for Rigid Persistence, and CR was .75 for Flexible Persistence and .86 for Rigid Persistence.

We examined the scale invariance across sex following Vandenberg and Lance (2000)'s sequence. We used ESEM and compared progressively more restrictive nested models across groups. Model 1 (CONFIGURAL) has factor means fixed to zero, and factor loadings, intercepts and residual variances free across groups. Model 2 (METRIC) has factor means fixed at zero in all groups, factor loadings constrained to be equal across groups and intercepts and residual variances free across groups. Model 3 (SCALAR) has factor means fixed to zero in one group, factor loadings and intercepts constrained to be equal across groups and residual variances free across groups. A decrease in CFI > .01 or TLI > .01 or an increase in RMSEA > .015 across models indicates a significant decrement of fit and, in turn, non-invariance (Cheung & Rensvold, 2002). Overall, the results for all models had good fit indexes and showed non-significant differences for gender (Table 3). However, there was a difference of .013 in CFI and a significant χ^2 change between models 2 and 3, which might be evidence for partial scalar invariance.

Table 3
Analysis of invariance across gender

	df	χ^2	CFI	TLI	RMSEA
Model 1	38	101.078	.936	.905	.085
Model 2	44	114.392	.928	.909	.083
Model 3	50	133.354	.915	.905	.085

Structural Equation Model

Descriptive statistics and correlations among the variables were calculated (Table 4). Then, we used a structural equation analysis to test the relationships between the variables tested. We ran an SEM. Following the theoretical framework, we hypothesized that Harmonious Passion would positively predict Flexible Persistence and negatively predict Rigid Persistence, and that Obsessive Passion would positively predict Rigid Persistence and negatively predict Flexible Persistence. In turn, Flexible Persistence and Rigid Persistence would lead to Intention to Stay (activity outcome), but only Flexible Persistence would predict subjective vitality (life outcome). The results revealed adequate fit indexes for the model: χ^2 (200, 413) = 987,757 (p < .001), RMSEA = .08, CFI = .938, TLI = .930. As shown in Figure 1, Harmonious Passion was positively associated with Flexible Persistence (β = .804; SE = .041; p < .01) and negatively associated with Rigid Persistence (β = -.115; SE = .060; p = .05). Regarding Obsessive Passion, it positively predicted Rigid Persistence (β = .684; SE = .060;

p < .01), and negatively predicted Flexible Persistence (β = -.312; SE = .070; p < .01). Regarding the outcomes, Flexible Persistence significantly predicted Subjective Vitality (β = .721; SE = .039; p < .01) and Intention to Stay (β = .641; SE = .065; p < .01). However, Rigid Persistence was related to a much lesser extent to Intention to Stay (β = .091; SE = .077; p = .241). To complete our model, we looked at the mediational pathways of flexible persistence in the relationship between harmonious passion and the outcomes. The unstandardized indirect effects were significantly different from zero only for subjective vitality (β = .376; *SE* = .103; p < .001).

The direct effects from harmonious passion to subjective vitality (β = .244; *SE* = .116; p = .036) and intention to stay (β = .496; *SE* = .094; p < .001) were significantly different from 0.

Table 4

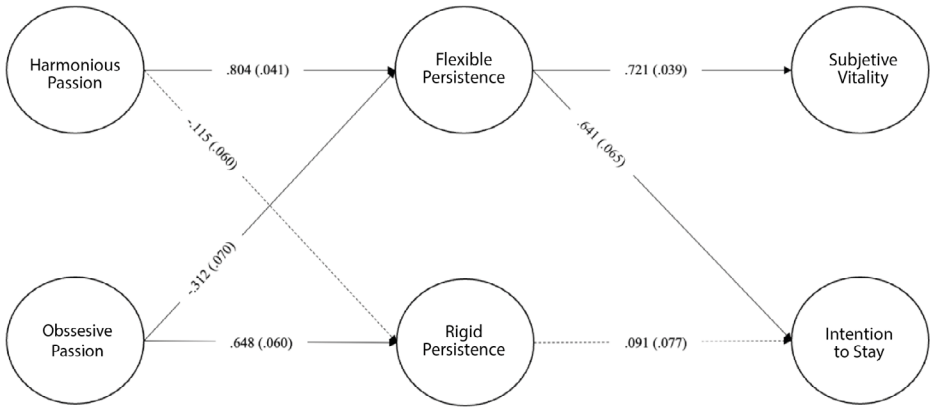
Means, standard deviations, and correlations among major variables

Variable	M	SD	1	2	3	4	5	6
1. HP	5.233	1.108	-					
2. OP	2.911	1.171	-.032	-				
3. Flexible persistence	5.750	0.860	.413***	-.318***	-			
4. Rigid persistence	2.810	1.362	.011	.456***	-.163***	-		
5. Subjective vitality	4.879	1.187	.522***	-.157***	.430***	-.015		
6. Intention to stay	5.391	1.048	.566***	-.238***	.428***	-.123**	.640***	-

Note. * p < .05, ** p < .01, *** p < .001.

Figure 1

Results of the structural equation model with university teachers. The standardized parameters are above the arrows; standard errors are between parentheses.



DISCUSSION AND CONCLUSIONS

The aim of this study was twofold. First, we tested the relationships between flexible and rigid persistence, harmonious and obsessive passion, and adaptive outcomes inside and outside the activity of teaching. Second, we analyzed the psychometric properties of the Spanish version of the Flexible and Rigid Persistence Scale (Chichekian & Vallerand, 2022; Vallerand et al., 2022). Overall, the results supported the hypotheses tested. We tested the validity of a structural equation model on the role of passion and persistence in activity and life outcomes. In line with the Dualistic Model of Passion (Vallerand, 2015) and the findings from Chichekian and Vallerand (2022), we hypothesized that harmonious passion would positively lead to flexible persistence and, to a lesser degree, to rigid persistence, and that obsessive passion would positively predict rigid persistence and negatively predict flexible persistence. In turn, we also hypothesized that both types of persistence would predict intention to stay (activity outcome). However, only flexible persistence was expected to predict subjective vitality (life outcome). These hypotheses were all supported except for one. Specifically, harmonious passion was not found to significantly relate to rigid persistence. Regarding the secondary aim, results evidenced the psychometric adequacy of the Spanish version of the scale. Specifically, results supported the two-factor structure of the scale by ESEM, which indicated a satisfactory fit.

Results showed similar factor loadings and replicated the two-factor structure proposed by Chichekian and Vallerand (2022) and Vallerand et al. (2022). These findings support the existence of a bi-factorial scale structure regarding the two forms of persistence. Second, regarding the evidence of internal consistency, we used AVE, CR, and McDonald's Omega (1999), whose values are interpreted in a similar way to those of Cronbach's Alpha. Nevertheless, this index seems to be more accurate (Yang & Green, 2010), as it does not require data to be continuous (Bonanomi et al., 2015; Elosua & Zumbo, 2008) and does not state that the factor loadings of all items are equal (McNeish, 2017). Internal consistency revealed adequate levels for the scale and both types of persistence subscales, and scores for flexible persistence were even slightly lower. These results are similar to those found in the original version and present preliminary evidence of validity and reliability. Lastly, although the invariance test across sex had good fit indexes and showed, overall, non-significant differences for gender, a significant χ^2 change between models 2 and 3 could evidence a partial scalar invariance, suggesting being cautious about supporting the assumption of gender invariance.

These findings lead to four important conclusions. The first conclusion is that as hypothesized by Vallerand (2015), the two types of persistence lead to different outcomes. Specifically, whereas the two types of persistence positively predict persisting at work, only flexible persistence predicted psychological wellbeing in one's life. These findings are line with the Dualistic Model of Passion that posits that with harmonious passion, people display some flexible persistence thereby fostering full engagement and wellbeing in the process. With obsessive passion, however, rigid persistence is achieved within the passionate activity but very often at the expense of wellbeing in one's life. The results of the present study are consistent with those of Chichekian and Vallerand (2022). Specifically, in two studies, these authors found positive and significant relationships between harmonious passion and flexible persistence, as well as between obsessive passion and rigid persistence. However, Chichekian and Vallerand also obtained a smaller link between harmonious passion and rigid persistence. Future research is necessary to establish if this difference is due to the types of participants (teachers v. students) or to some other variable. Regarding the outcomes, our results are also partially consistent with Chichekian and Vallerand (2022). As in the present findings, these authors found that both flexible and rigid persistence led to adaptive outcomes while performing the activity one is passionate about (in this study, intention to stay at work), whereas only flexible persistence was related to positive outcomes outside the activity (in this study, subjective vitality). Following Chichekian and Vallerand (2022), this was expected because flexible persistence is underpinned by harmonious passion, so the passionate activity is in harmony with the other areas of people's lives. Harmonious passion

allows people to persist toward the passionate activity while attending to other experiences, activities, or life goals. However, the present results showed that the relationship between rigid persistence and the activity outcome (intention to remain at work) was only tangentially significant. Future research is necessary to replicate these findings. Finally, the present findings provide support for the validity and reliability of the Flexible and Rigid Persistence Scale in Spanish. Results of a ESEM and reliability analyses supported the two-factor structure of the scale.

Although findings of our study provide evidence that show that the Spanish version of the scale may be used to assess both types of persistence, it has some limitations. First, due to the small sample size, we must be cautious about the evidence of validity and reliability. Future research should conduct studies with larger and more diversified samples (e.g., high school teachers) Second, the constructs in this research were all measured using self-reported instruments. Although our findings are in line with theory (Vallerand, 2015) and previous research (Chichekian & Vallerand, 2022), we encourage future studies to also use other measures such as informants and even physiological measures (Vallerand et al., 2022). Third, because we used a cross-sectional design, we cannot make inference of causality between the variables tested. We propose that future research use longitudinal studies to test the relations between both types of passion, both types of persistence and different outcomes. Fourth, since one of the researchers who contribute to the translation process was an expert regarding the content of the construct measured and the original version, we missed providing content validity regarding the Flexible and Rigid Persistence Scale. Finally, the present research did not use the quadripartite approach of passion (Schellenberg et al., 2019) because it sought to test the pure effects of each of the harmonious and obsessive passions on flexible and rigid persistence. Future research should do so.

To conclude, in general, the present results yielded preliminary evidence of the reliability and validity of the persistence construct in line with those of the original version (Vallerand et al., submitted). These findings suggest that the scale is ready to be used in future research, thereby leading to new and exciting research on the role of flexible and rigid persistence in education.

Implications for educational practice

This study provides practical implicational for the educational context. Because it is generally accepted that the more passion and persistence, the better the success, people sometimes keep persisting in a passionate activity even while suffering or experiencing negative outcomes or costs. Although previous studies have widely shown that the different types of passion, harmonious and obsessive, lead to different outcomes, this novel perspective of persistence extends the knowledge and contributes to previous research by dealing with the distinction between different types of persistence in terms of their quality. Evidencing that flexible persistence leads to achieving the activity goals and allows satisfaction with other areas of life could help to design and implement more specific training programs to show teachers the importance of harmonious passion and flexible persistence, both for their teaching practice and for their life. In terms of knowing how to improve teachers' satisfaction and well-being is relevant, among others, because it is related (e.g. Pascual-Gómez & Arteaga-Martínez, 2020) to their students' optimal achievement and performance.

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APÉNDICE

Items of the Spanish version of the Flexible and Rigid Persistence Scale

Flexible Persistence

1. Me esfuerzo mucho por conseguir mis objetivos laborales, pero también me importan otras cosas.
2. Me esfuerzo mucho por conseguir un objetivo laboral, pero puedo parar si es necesario.
3. Me centro en mi trabajo cuando tengo que hacerlo.
4. Intento alcanzar mis objetivos laborales, pero no a expensas de otros objetivos en mi vida.

Rigid persistence

1. Estoy dispuesto a hacer lo que sea para llegar a lo más alto en mi trabajo.
2. Cuando se trata de alcanzar mis objetivos en el trabajo, nada más me importa.
3. Tengo claro que para tener éxito en el trabajo tengo que centrarme sólo en mis objetivos laborales.
4. Estoy dispuesto a renunciar a algunas cosas de la vida para tener éxito en mi trabajo.

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Lights and shadows in university students' perceptions of inclusion and diversity

Luces y sombras en la percepción del alumnado universitario acerca de la inclusión y la diversidad

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ABSTRACT

The ongoing increase in the number of students with barriers to presence, participation and learning who attend universities around the world requires reflection on the policies, cultures and practices that promote or hinder it. This mixed research, predominantly qualitative, aims to analyses these three elements from the perspective of students in the Galician University System. It is developed in three stages: a first quantitative stage, in which data is collected through a questionnaire applied to 296 students of Early Childhood Education (n = 132), Primary (n = 100), Social (n = 35) and Speech Therapy (n = 30); a second qualitative stage, in which the responses of 174 students (130 students of Primary Education and 44 of Early

Childhood Education) are analysed in an online discussion forum; and a final qualitative stage, through semi-structured interviews and elaboration of mind maps with a group of six students. The results showed the cross-analysis of the qualitative discourse and the quantitative assessments of the students, which allowed the elaboration of a mind map that reflects the facilitators (space for support, help and attention; fellowship and socialization; pedagogical, psychological and emotional support from the teacher; respectfulness and maturity) and barriers to inclusion at university (overcrowded classrooms; lack of individualization and adaptation of teaching; multitasking profile of the teacher; poorly adapted facilities). In conclusion, the historical and social evolution of inclusion generates diverse narratives and expectations that require a joint action of listening and responding to questions to understand and accept diversity. It is not a matter of approaching inclusion through policies that are distant from educational cultures and practices. Including learners with major diversities in classrooms is a major step forward, but it should not be hidden that inclusion is a process that affects the whole of society.

Keywords: inclusion, access to education, student diversity, equal education, higher education

RESUMEN

El continuo aumento de alumnado con barreras para la presencia, participación y aprendizaje que acude a las universidades en todo el mundo, exige reflexionar sobre las políticas, culturas y prácticas que lo potencian o dificultan. Este artículo, de corte mixto con predominancia cualitativa, pretende analizar estos tres elementos desde la percepción del alumnado del Sistema Universitario de Galicia. El estudio se desarrolla en tres etapas: la primera cuantitativa, recogiendo datos mediante un cuestionario aplicado a 296 estudiantes de Grados en Educación Infantil (n = 132), Primaria (n = 100), Social (n = 35) y Logopedia (n = 30); la segunda cualitativa, analizando las respuestas de 174 estudiantes (130 de Grado en Educación Primaria y 44 de Infantil) en un foro de discusión online; y la tercera cualitativa, mediante entrevistas semiestructuradas y elaboración de mapas mentales con un grupo de seis estudiantes. Los resultados mostraron el análisis cruzado del discurso cualitativo y las valoraciones cuantitativas del alumnado, que permitió elaborar un mapa mental que refleja los facilitadores (espacio de apoyo, ayuda y atención; compañerismo y socialización; apoyo pedagógico, psicológico y emocional del docente; respeto y madurez) y barreras para la inclusión en la universidad (masificación de las aulas; falta de individualización y de adaptación de la docencia; perfil multitarea del docente; instalaciones poco adaptadas). En conclusión, la evolución histórica y social de la inclusión genera narrativas y expectativas diversas que requieren una acción conjunta de escucha y respuesta frente a los interrogantes para entender y aceptar la diversidad. No se trata de abordar la inclusión mediante políticas alejadas de las culturas y prácticas educativas. Incluir alumnado con diversidades mayores en las aulas es un gran avance, pero no se debe ocultar que la inclusión es un proceso que afecta a toda la sociedad.

Palabras clave: inclusión, acceso a la educación, diversidad de estudiantes, educación igualitaria, educación superior

INTRODUCTION

Since the Salamanca Statement (United Nations Educational, Science and Culture Organization, UNESCO, 1994) there have been changes in Education Systems related to inclusion with different levels of application and implementation depending on the country (Magumise & Sefotho 2020). It keeps open the debate on what we mean by inclusive education (Paseka & Schwab, 2020) and how to respond, through this principle, to the diversity of students who face informative, bureaucratic, architectural, learning, personal and social barriers, which derive from different educational needs and learning demands (García-González et al., 2021). In spite of responding exclusively to those students who are at greater risk of segregation, marginalization, or school dropout because of their special educational needs, inclusive education must be addressed to all people regardless of their cultural, social, biological, affective, intellectual or any other characteristics (Ainscow 2020; Echeita 2017).

Education policy commitments to the principles of inclusive education and their concretisation in the form of treaties or laws are worthless if they are not translated into real educational practices, and if schooling rules and procedures that facilitate exclusion and segregation of learners and do not provide truly individualised attention in the classroom are maintained. Educational and social exclusion will persist as long as there is no further recognition of all excluded people (Bartolomé et al., 2021) and the emergence of new groups with barriers resulting from differentiated social phenomena (Salmi & D'Addio, 2021), such as armed conflicts or natural disasters.

One of the Sustainable Development Goals (SDG4) of the 2023 Agenda focuses on ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all (Ramos et al., 2021), including equal access for all men and women to quality technical, vocational, and higher education, including university education (UNESCO, 2017). University education must establish a balance between educational legislation, university legislation and legislation on disability, so that the very fact of implementing the social model of disability does not necessarily keep up with the development of university regulations, which can generate a situation of legal uncertainty for students and teachers, among other agents involved (Alcáin & Medina-García, 2017). Despite the benefits and support for this model (Collins et al., 2019), it still faces challenges such as the need to expand the variety and flexibility of university education, guarantee the quality and parity of the training

offer, provide access to information, and create communication networks, and improve staff effectiveness.

The university and the inclusive education of people with functional diversity

Inclusion requires the development of actions and practices aimed at attending the diversity, building a sense of belonging and recognizing the value and dignity of all people (UNESCO, 2020). The universities' mission is education, Research and contribution to society, the latter being an element closely linked to social inclusion (Campos, 2021). Hence the relevance of the culture of inclusion as one of the quality indicators in higher education.

Higher education provides an opportunity for social mobility, in face of unemployment and precariousness through prestige, recognition and economic and financial remuneration (Comité Español de Representantes de Personas con Discapacidad, CERMI, 2020). Students from vulnerable backgrounds face economic and social barriers to university access, and likely academic, educational and/or cultural difficulties (Ramírez & Maturana, 2018; Salmi & D'Addio, 2021).

Increasing numbers of students with barriers to presence, participation, and learning attend universities around the world, which calls for reflection on the institutional policies, practices and structures that are promoted or ignored (Araneda-Guirriman et al., 2017). Despite the

Despite the adjustments required of universities to provide room for students with disabilities, the fulfilment of their rights is conditioned by the degree of accessibility of educational environments, which has led to actions aimed at reducing physical or access barriers to the curriculum (Sandoval et al., 2020). However, most Spanish universities have been designed to receive non-disabled students this can be noticed both in the physical structures and in the curricular designs, methodologies, and training of teaching and administrative staff (García-González et al., 2021).

This paper focuses on analysing inclusion, specifically, university students' perceptions of how inclusive policies (plans and programmes), cultures (values, shared beliefs) and practices (actions, such as ways of teaching, organising the classroom and assessing learning) are developed at the university (Fernández-Blázquez et al., 2022). To this end, the objectives are: (a) to deepen the students' vision of the university and the processes of inclusion that take place in it (policies, cultures and practices) and (b) to identify the main factors that enhance and limit the configuration of the university as a space for student inclusion.

METHOD

A mixed study was carried out in three stages: a first quantitative stage, where an initial approach to the field of study was made, and a second and third qualitative stage, delving into the participants' discourses on diversity and university inclusion. The scope of this study is not only to take advantage of the potential of mixed research (Stacciarini & Cook, 2015), but to give the qualitative perspective a primary character that is complemented by the secondary quantitative insights.

Participants

Students from the three universities of the Galician University System (University of A Coruña, University of Santiago de Compostela, and University of Vigo) participated in the research. The quantitative study involved 296 students (*n* = 44 males, 14.9%; *n* = 252 females, 85.1%) aged between 18 and 60 years (M = 20.90; SD = 4.27); Degree in Early Childhood Education (*n* = 132, 44.4%), in Primary Education (*n* = 100, 33.7%), in Social Education (*n* = 35, 11.8%) and in Speech Therapy (n = 30, 10.1%). For the qualitative study, 174 university students participated, of whom 130 were studying the Degree in Primary Education and 44 in Early Childhood Education at the three universities mentioned above.

Instruments and data collection

Data was collected during an academic year (Table 1) following the criteria from the Ethic Committee of the American Psychology Association (APA, 2017) regarding confidentiality, anonymity, respect for the opinions of the participants, voluntary participation, and the signing of informed consent.

Table 1
Methodological development of the study

Stage	Approach	Aim	Participant	Data collection
Stage I	Quantitative	(b) to identify enhancing and hindering factors for university inclusion.	296 students	Scale of Perceptions about University Inclusion (SPUI)
Stage II	Qualitative	(a) to collect students' perceptions about university inclusion.	168 students	On-line discussion groups (OLDG)
Stage III	Qualitative	(a) to deepen in students' interpretations.	6 students	Interviews and mind maps.

In the Stage I the instrument that was used to collect quantitative data was the Scale of Perceptions about University Inclusion (SPUI). It is a 34 items tool that assess the inclusion culture, policies and practices through a 5-point Likert scale (0: no/never, 1: hardly ever, 2: sometimes, 3: usually, and 4: Yes/always). It was designed *ad hoc* by the researchers. The study of its psychometric properties (Losada-Puente et al., 2021) revealed an initial factor structure in six factors (building communities, establishing inclusive values, developing a centre for all, organising supports, organising learning and mobilising resources) that explained 52.04% of the variance. Subsequently, a structure composed of these six first-order factors was confirmed, grouped around three second-order factors: culture, policy and inclusive practices (χ^2/gl = 1.494, CFI = .951, GFI = .871; RMR = .041, RMSEA = .041). The reliability of the instrument was excellent (α = .946; r_x = .868). In the present study, the instrument had excellent internal consistency (α = .951), as did its dimensions (α culture = .863; *α* politics = .863; *α* practice = .922).

Due to the health measures adopted in the institutions of the Galician University System, an interactive space was created (Stage II) through a forum for students to discuss inclusion in a targeted manner. In order to deepen the students' appraisals of university inclusion, the technique selected was *rapid online focus groups* (Blake et al., 2021) (also called reflective essays by Rahiem et al., 2021). For this purpose, different sequential moments of reflection were proposed: intrapersonal (individual evaluations) and interpersonal (group evaluations resulting from the interactions between participants) by means of written word (Table 2):

Table 2
Schedule of the reflection sessions in the Stage II

Session	Development	Questions	Timing	Information provided
Awareness-Raising	1. Intrapersonal reflection: ice-breaking question regarding inclusion. 2. Interpersonal reflection: free group interaction from individual responses.	What inclusion means for you? Which words or ideas suggest to you?	1 week	159 individual posts 30 replies
Deepening 1: Inclusive Culture	1. Intrapersonal reflection: specific questions regarding inclusive policy, culture and practices at the university. 2. Interpersonal reflection: from the individual responses, an interactive discussion was carried out. Hosted by experts on the topic (university professors with research expertise in inclusion)	Are university classrooms welcoming, safe and collaborative spaces where ALL people have a room?	1 week	156 individual posts 12 replies
Deepening 2: Inclusive Policy		Does the university take measures to pay attention to student diversity (provision of services, resources and support, teacher training, adaptation of infrastructures...)?	1 week	152 individual posts 17 replies
Deepening 3: Inclusive Practices		Do university teaching staff have and make use of material and personal resources to respond to student demands/needs?	1 week	140 individual posts 17 replies

Finally (Stage III), we delved into students' personal perceptions on inclusion based on their university experience. Virtual semi-structured interviews were applied to a group of informants (6 women) who had also participated in Stage I. Moreover, participants also elaborated mind maps. The first technique was composed of eight questions related to the university-high school relationship, experiences in the institution, spaces, or training resources. For instance, they were asked: "How would you define the relationship between students and professors?",

"What do you think about competitiveness among university students?" or "Do you perceive your faculty as an inclusive environment? The mind maps, on the other hand, were free representations of their personal view of inclusion at university.

Data collection

The qualitative craft analysis was developed under the Miles and Huberman Model (Miles et al., 2013) in two stages: firstly, deductive and, secondly, inductive. Initially, three main categories were established deductively (culture, policies, and practices of inclusion), and later the researchers carried out a second inductive and transversal analysis where three thematic categories were identified. These themes make up the results of this work: perceptions of the university institution and inclusion, environments and spaces, and coexistence in the university.

In parallel to the qualitative analysis process, the SPUI data were studied by means of IBM SPSS 27 Statistical Package. Descriptive (central tendency and dispersion) and inferential analyses were carried out using parametric statistics (Student's t-test). A confidence level of 95 ($p < .05$) was considered. The initial descriptive analyses served as a starting point to situate the interest of the study around the three main themes addressed in the focus groups and were subsequently useful to quantitatively support the participants' discourse.

RESULTS

Preliminary results

From the initial analysis of the quantitative data (Table 3) it was found that, on average, students placed the level of inclusiveness at the university in the middle of the 0-4 scale (M = 2.68; SD = 0. 55); that is, only *sometimes* the University favours inclusive culture (M = 2.71; SD = 0.55), policy (M = 2.50; SD = 0.72) and practices (M = 2.48; SD = 0.71), so there is still room for improvement. Most items were placed in the category *sometimes*, although with a positive tendency towards usually, with exceptions placed in the category *sometimes*, with a negative tendency towards *hardly ever*.

In terms of inclusive culture, the establishment of inclusive values (M = 2.72; SD = 0.61) was highlighted, where there is *usually* agreement between university and professors in understanding diversity; however, it is only *sometimes* perceived that professors place great expectations on all students. Likewise, in community building (M = 2.70; SD = 0.63) it was noted that faculty and students *usually* treat each other with respect, but coordination between professors only *sometimes*

occurs. Regarding the inclusive policy, there was a positive tendency towards considering that support is *usually* organised (M = 2.61; SD = 0.81); however, there was a tendency to consider that the University *hardly ever* is developed for all students (M = 2.3; SD = 0.79), especially regarding the support given to students when they join the University System or the organisation of learning groups so that students feel valued. Inclusion practices stood out positively in the organisation of learning (M = 2.48; SD = 0.71), above all in that *sometimes* and with a tendency to be *usually*, professors try to make students do things to the best of their ability. To a lesser extent, resources are mobilised (M = 2.37; SD = 0.85), with the resources that professors generate to support learning and participation being particularly noteworthy.

Table 3

Descriptive statistics on the values of inclusion culture, policy and practices at the university

Dimension/ subdimension/item	M	SD	Min	Max.
Inclusive culture	2.71	0.55	1.11	4
Building communities	2.70	0.63	1	4
In this faculty all students help each other.	2.49	0.87	0	4
Professors coordinate with each other.	2.27	0.82	0	4
Professors and students treat each other with respect.	3.01	0.80	0	4
The faculty is open to the social community.	2.93	0.91	0	4
In the faculty there is an atmosphere of quality and pleasant living.	2.79	0.79	1	4
Stablishing inclusive values	2.72	0.61	0.78	4
Professors favour one group of students over others.	2.60	0.89	0	4
Great expectations are placed on all students.	2.38	0.84	0	4
Professors try to remove all barriers to learning and participation in the faculty	2.54	0.94	0	4
The faculty strives to reduce discriminatory practices.	2.81	0.88	0	4
Professors and University share the philosophy of inclusion.	3.02	0.83	1	4
Professors believe that all students are equally important.	2.85	0.89	0	4

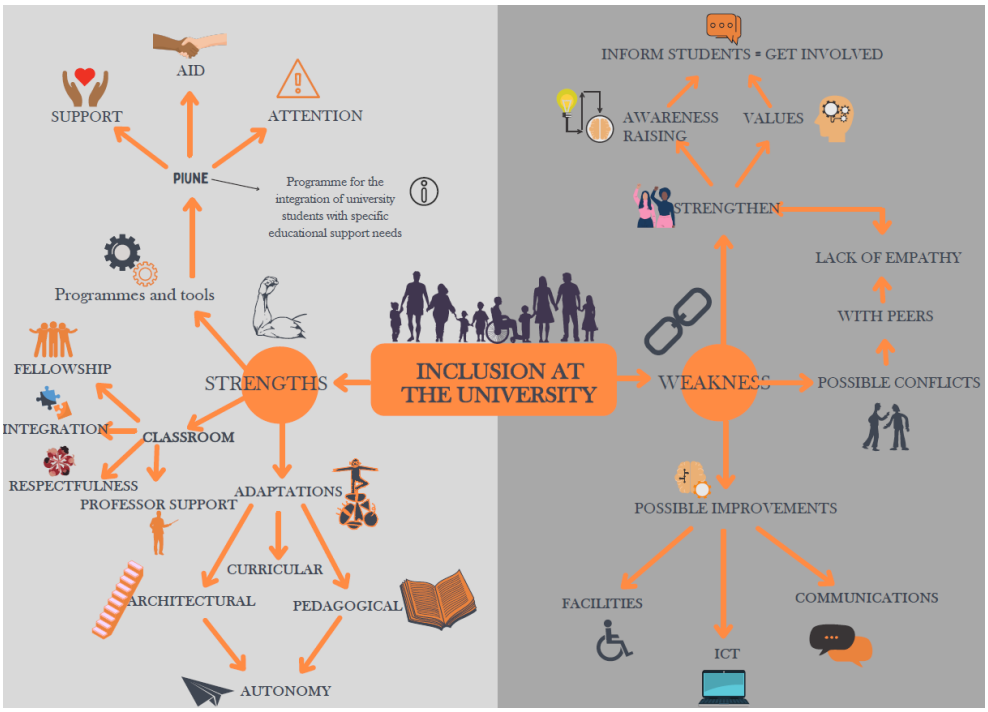
Dimension/ subdimension/item	M	SD	Min	Max.
Professors and students are treated as individuals and have a “role”	2.91	0.85	0	4
Professors show equal concern for all learning groups	2.63	0.88	0	4
At the faculty there are attempts to prevent bullying and harassment.	2.69	1.07	0	4
Inclusive policy	2.50	0.72	0	4
Developing a faculty for all	2.38	0.79	0	4
The faculty makes its building physically accessible for all.	2.52	1.13	0	4
When the students join the faculty for the first time, they are helped to adapt.	2.09	1.14	0	4
The faculty organizes learning groups so that all students feel valued.	2.25	1.02	0	4
Classes are responsive to the diversity of learners.	2.45	0.94	0	4
Classes are made accessible to all learners.	2.60	0.99	0	4
Organizing the diversity of supports	2.61	0.81	0	4
Special educational needs” policies are policies of inclusion.	2.73	0.91	0	4
Assessment practices and pedagogical support are used to reduce barriers to student learning and participation.	2.50	0.93	0	4
Psychological and emotional support is related to curriculum development and pedagogical support.	2.60	1.00	0	4
Practices of inclusion	2.48	0.71	0.39	4
Organizing learning	2.59	0.68	0.22	4
Proffesors encourage students to do their best.	2.82	0.87	0	4
Students are encouraged to come to classes.	2.57	1.02	0	4
All forms of support are coordinated.	2.27	0.89	0	4
Lessons promote the understanding of differences.	2.64	0.94	0	4
Students are actively involved in their learning.	2.52	0.88	0	4

Dimension/ subdimension/item	M	SD	Min	Max.
Students learn collaboratively.	2.74	0.89	0	4
Classroom discipline is based on mutual respect	2.76	0.92	0	4
Professors plan, Review and teach collaboratively.	2.49	0.91	0	4
Proffesors are concerned with supporting students learning and participation.	2.51	0.92	0	4
Mobilising resources	2.37	0.85	0	4
Community resources are known and used.	2.24	1.00	0	4
Diversity among students is used as a teaching-learning resource.	2.31	1.00	0	4
Professors generate resources to support learning and participation.	2.56	0.90	0	4
Total	2.68	0.55	1.12	3.86

Students' perception on university inclusion

As a starting point, the following mind map reflects the main thematic categories found around inclusion. They will be further explored below, reinforcing the participants' discourse with quantitative information.

Figure 1
Mind map on university inclusion



Note: source: Mind map, elaborated by participant 5.

Although both qualitative and quantitative questions were oriented towards the university, participants made constant allusions to their previous educational stage. The perceived differences between the two institutions (University - High School) and in their own responses to inclusion (Table 3) lead the participants to state that, before starting their university studies, they had an idealised outlook; however, their current perception of the university reflects the absence of notable differences with high schools ["they exist, but university is not so different from a high school, it is an extension of it" (S 159)].

They referred high schools as a "home-like" institutions, conferring them characteristics of a *familiar environment* such as the personalised attention, close relationships, or the family spotlight. On the contrary, they perceive the university as an overcrowded institution, depersonalized in the students' attention and where it is difficult establishing links with professors. Inclusion and attention to diversity at the University have been considered insufficient, noting that this

institution seeks to "give little importance to inclusiveness in classrooms and faculties; (...) it will last as long as you take care of it and you will take care of it as long as you want it, so the fight for inclusion in the university is neither wanted very much nor will it last" (S1).

Tabla 4
University-Higher Education duality

Representation	Indicators and evidence
Higher school as a "home-like" institution	Small educational communities, with low ratios, which facilitate familiarity and contact with all students, but "more closed to society and the surrounding context" (GRDL).
	Individualised attention and personalised knowledge of students.
	Close relationships within the community.
	Uniform and stable institutional organisation.
	Little teacher turnover: greater individualism among teachers, greater contact with students.
	Teaching staff dedicated exclusively to teaching.
	Use of traditional methodologies.
	Family sportlight.
University as a "factory-like" institution	Overcrowded educational community that makes contact difficult, but "*more in harmony with society*" (GRDL).
	Overcrowded classrooms: depersonalised attention and ignorance of needs/demands.
	Distant relationships and difficulty in establishing links; new relationships between peers as "*young but mature and respectful adults*" (GRDL).
	Changing and versatile institutional organisation: four-monthly changes.
	Professors as "*mere exhibitors of academic knowledge dedicated to teaching, but above all to research*" (GRDL).
	Many professors, more coordination, less direct contact with students.
	More mature" academic environment: meaningful learning through different methodologies (from traditional to active).
	Absence of families as educational agents.

Participants pointed out that the main barriers to the university inclusion come from the professors-students ratio. The considerable number of students in a compulsory subject (approx. 90-100 people) makes it difficult to know individual needs/demands. It was criticised that professors do not know their students because "the time they spend with their students is very little and they always work in large groups, which makes it difficult to get to know the characteristics and diversity of the students" (S83). Others mention the way learning is organised in this space as an argument against this criticism and as justification for the *cold and distant teacher-student relationship* that causes,

> (…) they do not have the individualised treatment that the students themselves would like or even the professors, which is quite normal, because although they make their best efforts, it is almost impossible for one of our professors, who only gives us one semester, sometimes not even that, to contact and get to know more than 100 students (S14).

Overcrowding in university classrooms hinders attention to diversity and personalisation as pedagogical principles, from the organisation of a subject to the teaching methodology. The very "form and structure" of the institution means that it is the students who have to adapt to a university that is "very difficult to change, so there is no other solution than to adapt ourselves" (S93). Moreover, overcrowding is seen as "incompatible" with individualised teaching attention, since the efforts made "happen in an improvised and decontextualised way" (S116). Even though students seem to understand and accept that this institutional structure does not favour personalised attention to students, they place this responsibility on the professor:

> The university system is oriented towards more distant teaching, where students must be more autonomous in their learning. And I am reluctant to think that "there is no other way", because as soon as it is known that the professor influences the students, it would be necessary to know these students (S65).

However, another perceived barrier appears here: the multitasking profile of the professors. The aspirations of the majority of professors, mainly towards research or scientific dissemination, were pointed out as "a factor that rivals the possibility of offering personalised attention" (S3). Furthermore, there is a negative appraisal of professor-student relationship at the university. Professors' attitude is perceived as distant and uncommitted to inclusion, which makes it harder for students to share their situation or demands, since "if a professor is apathetic and distant, students perceive communication as a nuisance, so they avoid it, even if it is harmful" (S3).

The discourse on this distancing seems to be linked to the *more practical component of inclusion* (organizing learning and mobilizing resources). Precisely

the *practical dimension* received the lowest scores (Table 5). In the organisation of learning, discipline based on mutual respect (M = 2.76, SD = 0.92) stood out, in line with the demand for a "young but mature adult" peer relationship (S148), and followed by "collaborative learning" (M = 2.74, SD = 0.89), although this does not exempt the presence of difficulties "in contact with/among students" (S3, S57). They also valued positively the promotion of understanding diversity in the classroom (M = 2.64, SD = 0.94) and the active involvement of students in their learning (M = 2.52, SD = 0.88), which reinforces the search for "meaningful learning" (S101, S116). However, the way in which professor plan, review and teach collaboratively (M = 2.49, SD = 0.91), related to a "changing and flexible" institutional organisation (S105), was considered to be an area for improvement.

Table 5

T-test for the contrast between for the contrast between culture, policy and practices of inclusion in the university

Dimensions and subdimension	Dif M	SD	T	Df	95% CI		d
					Lower	Upper	
Culture-Policy	0.21	0.54	6.715**	297	0.148	0.271	0.54
C1/C2	-0.02	0.60	-.525	296	-0.086	0.05	
C1/Po1	0.31	0.76	7.156**	296	0.228	0.400	0.60
C1/Po2	0.09	0.74	2.037*	296	0.043	0.003	0.74
C2/Po1	0.33	0.65	8.866**	296	0.258	0.406	
C2/Po2	0.11	0.68	2.692*	296	0.039	0.029	0.65
Policy-Practices	0.23	0.48	0.548	296	-0.04	0.07	0.68
Po1/Po2	-0.23	0.70	-5.597**	296	-0.305	-0.146	0.70
Po1/ Pr1	-0.21	0.59	-6.062**	296	-0.067	0.093	0.59
Po1/Pr2	0.01	0.71	0.324	296	-0.067	0.093	
Po2/Pr1	0.02	0.61	0.480	296	-0.053	0.088	
Po2/Pr2	0.24	0.73	5.650**	296	-0.053	0.087	0.73
Practices-Culture	0.02	0.48	-8.090**	296	0.175	0.280	0.48
Pr1/Pr2	0.22	0.60	6.35**	296	0.153	0.291	0.60
Pr1/C1	-0.11	0.62	-2.931*	296	-0.176	-0.035	0.62

Dimensions and subdimension	Dif M	SD	T	Df	95% CI		d
					Lower	Upper	
Pr1/C2	-0.12	0.49	-4.300**	296	-0.180	-0.067	0.49
Pr2/C1	-0.33	0.74	-7.639**	296	-0.411	-0.243	0.74
Pr2/C2	-0.35	0.69	-8.676**	296	-0.424	-0.267	0.69

Note. *p < .05; **p < .001. Acronyms: C1- Building communities; C2- Establishing inclusive values; Po1- Developing a centre for all; Po2- Organising diversity of support; Pr1- Organising learning; Pr2- Mobilising resources.

Table 4 shows that the appraisal of the *inclusive culture* is significantly higher than the *inclusive policy* (p < .001), especially in the establishment of inclusive values, as well as in the *practice of inclusion* (p < .001). The university's capacity to build inclusive communities was rated higher than the organisation of learning in the classroom (p = .004) and resource mobilisation (p < .001), as was the establishment of inclusive values than the organisation of learning (p < .001) and resource mobilisation (p < .001). Consistent with these results, it is worth referring to the contribution of a participant who evidences the role attributed to the teacher and the university institution in the path towards educational and social inclusion:

> I often get the impression that some professors have some interest in us, but it's not true; I notice that they ask questions or that they want us to intervene simply out of commitment, because they teach us that a good part of learning must be interactive and didactic, and that's why they do it (...). Obviously, there will always be professors who are not like that and who really care about what we can contribute (...) Interest and inclusiveness cannot be forced (S152).

Students' perceptions about the university environments and spaces

Students recognise the existence of specific services to respond to their diversity (especially physical), but not other characteristics such as mental health or socio-economic problems. They also pointed out that, despite the reservation of places for people with functional diversity, the facilities have access barriers ["why can't blind, mute or deaf people come to the university? Therefore, they demand buildings and facilities adapted to different situations and/or people because, although the universities are concerned about physical adaptations (chairs for left-handed people, toilets for the disabled...), these are perceived as one-off actions in "old, inflexible facilities, which make it difficult to move around the centre" (S42, S70).

These results were also reflected quantitatively in the appraisal of resources to attend to diversity (*practices of inclusion*). As can be seen in tables 4 and 5, this was the lowest rated subdimension (M = 2.37, SD = 0.85), significantly below the others ($p < .001$, d = 0.60-0.74), especially in terms of knowledge and use of community resources (M = 2. 24, SD = 1.00), and in the use of diversity among students as a teaching-learning resource (M = 2.31, SD = 0.99). On the contrary, physical accessibility showed mean values with a positive tendency (M = 2.52) but with discrepancies between subjects (SD = 1.13).

Differences were found among the academic, the emotional and the social perception of the university facilities. Academically, learning spaces with a traditional architecture where "there are still platforms and distribution of tables in rows" (S2) stood out, alongside the use of traditional educational practices (e.g. not very participatory lectures). This would justify the high appraisal that professors and students are treated as having a role (M = 2.91, SD = 0.85), as the role of these two agents is clearly differentiated in the academic space.

On an emotional level, the environment and spaces are described as "respectful and mature" (S11, S13, S58), free to express opinions without being or feeling judged, as they are inhabited by *young adults* (S47, S55), so it is "difficult to see someone not respecting another classmate or creating conflicts" (E4). The university is considered to make efforts to reduce discriminatory practices (M = 2.81, SD = 0.88), to prevent bullying (M = 2.69; SD = 1.07) and to a lesser extent to organise learning groups so that students feel valued (M = 2.25, SD = 1.02) and to coordinate support (M = 2.27, SD = 0.91). The perceived efforts of professors to link curriculum development and pedagogical support with the psychological and emotional support of students (M = 2.60, SD = 1.00) stood out.

Lastly, the social perception of the university was that of a space that is prone to socialising and expanding their social network, despite the fact that the overcrowding in the classrooms leads them to prioritise creating and maintaining their most closed circle of friends ["there are people in my class with whom I have never spoken, it overwhelms me, I almost always limit myself to being with the same group of friends" (S55)]. Regarding the *inclusive culture*, there is a need to improve the help to adapt to the faculty (M = 2.09, SD = 1.13) and during the academic year (M = 2.49, SD = 0.86).

Students and formal coexistence at the University

Professors-students' relationships in Higher Education are *formal relationships* among adult people, where the recognition of the maturity and academic responsibility stood out, due to the "degree of maturity that we have" (S18). These relationships are also considered *fleeting relationships* "brief, prompt

and less close" (S35). Among peers' *collaboration and support, good job climate* and *commitment* stood out alongside *individualism* ["Undeniably the society is becoming increasingly individualistic, therefore selfishness begins to emerge affecting directly the system we are in, where grades are more important than general wellbeing" (S67)].

Students make the professors responsible for the promotion of the inclusive culture, policy and practices at the University since "they have a fundamental role since, depending on the classroom climate the interactions emerge on their own and in an effective way" (S43). They considered there was room for improvement in the way in which professors adapt classes for attending to students' diversity (M = 2.45, SD = 0.94), being accessible to all (M = 2.59, SD = 0.99) and promoting the understanding of diversity (M = 2.64 SD = 0.94). It was also reflected in contributions such as "the social, moral and psychological environment is perhaps not so welcoming in some universities where professors, not so much students, make negative statements from a position of authority, which generate stigmatisation and rejection (S6)"; even so, they value positively the respectful treatment between professors and students (M = 3.01, SD = 0.82) and the professors' attempts to make them do things to the best of their ability (M = 2.82, SD = 0.86), stating that "this way of working favours cooperation and our competitiveness, encouraging us to want to improve and to do things in the best possible way" (S10).

On average, t is perceived that all students are equally important (M = 2.85 SD = 0.89) and that there is some professors concern for supporting the learning and participation of all students (M = 2.51, SD = 0.92) and for resourcing them (M = 2.56, SD = 0.89). Even so, expectations do not seem to be the same for all (M = 2.38, SD = 0.84), considering that some students are favoured over others (M = 2.60, SD = 0.89), which can lead to competitiveness:

> As far as collaboration is concerned, although it is true that in the activities carried out in groups in the classroom, cooperation is perceived, I believe that competitiveness is still present as a result of the presence of a system that grades students according to a number that defines their abilities and places them in a position of superiority or inferiority with respect to the rest of their classmates (S25).

DISCUSSION AND CONCLUSIONS

The education system and the way in which it operates are decisive for making progress in reaching inclusion or, on the contrary, remaining anchored in exclusion (Fernández-Menor and Parrilla, 2021). Universities are making efforts to achieve inclusive Higher Education, seeking accessibility, participation and learning for all their students (Araneda-Guirriman et al., 2017; Moriña et al., 2019). The creation

of university participation and inclusion services or the detection and removal of physical barriers are a starting point, but may be insufficient; likewise, listening to students' needs must go beyond collecting information on the quality of professors through standardised systems (Calvo & Susinos, 2010) and delve deeper into the nuances of such assessments. This study aimed to provide an overview of the student's perception of inclusion at university, which has given both light and shade on the reality in Galician universities.

The change from high school to university education implies a break with significant people and institutions. There is a certain disappointment on seeing it as an infantilised environment in which two differentiating characteristics can be identified: overcrowded classrooms and the coldness of professor-student relationships.

Una explicación plausible es la escasa preparación docente en metodologías que permitan enseñar en un aula diversa y la sensación de desamparo al enfrentarse a la necesidad de dar respuesta a la diversidad (Perera et al., 2022). La educación inclusiva sitúa al estudiante como centro del proceso del *aprendizaje personalizado*, siendo esencial atender a sus conocimientos previos, necesidades, capacidades y percepciones (UNESCO, 2017) para diseñar espacios en los que este tenga un papel activo, evitando la pasividad y la dependencia (Calvo & Susinos, 2010).

Classroom overcrowding is a problem at international level (Araneda-Guirriman, 2017), which translates, in Spanish universities, into a lack of application of the principles of inclusive education, by maintaining assessments based on summative criteria as opposed to continuous assessment (Sandoval et al., 2020). One plausible explanation is the lack of professor preparation in methodologies that allow teaching in a diverse classroom and the feeling of helplessness when faced with the need to respond to diversity (Perera et al., 2022). Inclusive education places the student in the spotlight of the personalised learning process, and it is essential to address their prior knowledge, needs, abilities and perceptions (UNESCO, 2017) in order to design spaces in which they play an active role, avoiding passivity and dependence (Calvo & Susinos, 2010).

Professors' attention to emotional and social aspects is essential for students' all-round development. However, students are reluctant to share their concerns with their professors, perceiving them as cold and distant, while they do not seem to be aware of what the professors' concerns and obligations are. One of the great barriers in universities is the undervaluation of the unduly *excessive teaching burden* (Márquez & Melero-Aguilar, 2021), which leads them to direct their work towards the highly valued *research work* (Alcaín & Medina-García, 2017).

The development of an inclusive university requires efforts to develop cross-disciplinary training in inclusive education, so that work is carried out on the basis

of prevention, identifying barriers, generating beliefs and overcoming prejudices (Márquez & Melero-Aguilar, 2021; Salmi & D'Addio, 2021). Inclusive education is a term unknown to some professors, many of whom still adhere to the deficit model (Collins et al., 2019) and acknowledge the lack of knowledge of the current rules and regulations to address diversity (García-González et al., 2021; Rangel-Baca, 2021). However, research also indicates that professors who are inclusive use similar methodological strategies aimed at all students (Moriña & Orozco, 2022).

This research shows that universities must adapt to the students and not the other way around, a principle on which the models of inclusion and the paradigm of support that today preside over educational proposals and attention to diversity are based. Professors need training in inclusion and universities need a firm institutional commitment (Bartolomé et al., 2021; Perera et al., 2022) and the implementation of inclusive policies and practices.

An optimistic result in this research points to the importance that students attach to social relationships of respect and support in the university, which transcend the academic sphere. The university plays a crucial role in students' lives, becoming a real-life opportunity (Calvo & Susinos, 2010) which, given the aforementioned overcrowding, forces them to group together in small circles of support that may tend to create stronger ties. Discrepancies regarding the benefits and prejudices of the university environment have already been highlighted by previous literature, both in students (Collins et al., 2019; García-González et al., 2021; etc.) and in other key agents, such as families and/or professors (Magumise & Sefotho, 2020; Márquez & Melero-Aguilar, 2022; Paseka & Schwab, 2020).

In conclusion, educational inclusion generates diverse narratives and expectations that require joint action to listen and respond to the questions that may arise in order to understand and accept diversity (Opertti, 2019). What is clear is that it necessarily implies eliminating the homogenisation of the education system, where the integration background of special education is still palpable (Vigo-Arrazola et al., 2022), and understanding that inclusion refers to an education that revolves around diversity and where everyone has room. Therefore, it cannot be addressed exclusively through policies far removed from inclusive educational cultures and practices, because inclusion is a process that affects the whole student body, the institution and its members, and the processes of exclusion or inclusion do not arise naturally, due to certain intrinsic characteristics of individuals, but are constructed socially and relationally based on different opportunities (Unicef, 2017). Unfortunately, and despite the progress made, "it seems that the world is not on track to meet the 2030 education goals" (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020, p. 32).

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Digital fatigue in university students as a consequence of online learning during the Covid-19 pandemic

Fatiga digital en estudiantes universitarios como consecuencia de la enseñanza online durante la pandemia Covid-19

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ABSTRACT

The continued use of videoconferencing systems to carry out the teaching-learning process in higher education institutions during the Covid-19 pandemic has had a negative impact on university students' learning, causing digital fatigue. This fatigue mainly affects eyesight, emotional, motivational and social status. The aim of this study was to determine the degree of digital fatigue derived from prolonged exposure to videoconferencing systems among university students. For this purpose, a cross-sectional study design was applied based on the distribution of an online survey. A total of 613 university students aged 18-35 years

(M = 21.54, SD = 3.85) participated in the study. The results obtained revealed that: 1) the degree of prevalence of digital fatigue among university students was medium-high; 2) socio-demographic variables linked to being female, studying in the Arts and Humanities, spending more time in front of an electronic device and connecting via a laptop were indicators of a higher rate of digital fatigue; 3) gender and high hours consumption were predictors of visual fatigue, social fatigue, motivational fatigue and emotional fatigue; 4) visual fatigue, motivational fatigue and emotional fatigue, together with the field of study knowledge, had a significant influence on overall fatigue. Finally, the future lines of research of this work are discussed, highlighting the richness of the data obtained to advance knowledge about digital fatigue and its influence on university learning.

Keywords: digital fatigue, e-learning, higher education, ICT, Covid-19

RESUMEN

El uso continuo de los sistemas de videoconferencia para llevar a cabo el proceso de enseñanza-aprendizaje en las instituciones de educación superior, durante la pandemia derivada de la Covid-19, ha influido negativamente en el aprendizaje de los estudiantes universitarios, provocando fatiga digital. Esta fatiga afecta principalmente a la vista, estado emocional, motivacional y social. El objetivo de este trabajo fue determinar el grado de fatiga digital derivada de la exposición prolongada a sistemas de videoconferencia de los estudiantes universitarios. Para ello, se aplicó un diseño de estudio transversal a partir de la distribución de una encuesta en línea. En el estudio participaron un total de 613 estudiantes universitarios, con edades comprendidas entre los 18 y 35 años (M = 21.54; DT = 3.85). Los resultados obtenidos revelaron que: 1) el grado de prevalencia de la fatiga digital en los estudiantes universitarios fue medio-alto; 2) las variables sociodemográficas vinculadas a ser mujer, cursar estudios de la rama de Artes y Humanidades, pasar más tiempo frente a un dispositivo electrónico y conectarse a través de un ordenador portátil fueron indicadores de una mayor tasa de fatiga digital; 3) el sexo y el consumo elevado de horas fueron variables predictores de la fatiga visual, fatiga social, fatiga motivacional y fatiga emocional; 4) la fatiga visual, fatiga motivacional y fatiga emocional, junto a la rama de conocimiento de los estudios cursados, influyeron de forma significativa en la fatiga general. Finalmente, se discuten las futuras líneas de investigación de este trabajo, destacando la riqueza de los datos obtenidos para avanzar en el conocimiento sobre la fatiga digital y su influencia en el aprendizaje universitario.

Palabras clave: fatiga digital, e-learning, educación superior, TIC, Covid-19

INTRODUCTION

The Covid-19 pandemic made it necessary to digitise all, or a large part, of the teaching-learning process. In Spain, most universities had to adapt to a totally virtual scenario, being traditionally face-to-face universities. This posed a great challenge for both teachers and students. Thus, the impact of digital education due to compulsory confinement during the pandemic caused by Covid-19 had negative effects on the general well-being of university students (Elbogen et al., 2022).

The migration to online education increased the number of hours teachers and students spent in front of screens, either to manage learning processes on digital LMS (Learning Management System) platforms, as well as to attend classes via video calls (Ebner & Greenberg, 2020; Schuler et al., 2021), mainly on Zoom and Google Meet (Walcott-Bedeau, 2022). In this context, students reported increased episodes of stress and anxiety associated with time and dedication to digital activities, and less related to fear or worry about Covid-19 infections (García-González et al., 2022); similarly, increased screen work was associated with sleep disturbances (Zhang et al., 2021).

This situation marked a turning point in educational processes that demand to diagnose and analyse the negative effects on students' academic, psychosocial and socio-demographic development in order to ensure successful academic continuity for all (Williamson et al., 2020).

Several studies derived from distance education during the pandemic argue that online and hybrid models are here to stay (Ashour et al., 2021; Garay et al., 2021), therefore, more research needs to be conducted to understand the phenomenon and avoid further situations of digital fatigue, stress or burnout. In this sense, it is necessary to overcome the obstacles of digital fatigue that prevent students from achieving learning (Mpungose, 2021; Penson et al., 2020), so it is relevant to analyse this phenomenon related to the amount of time invested in videoconferencing, the behaviour according to subjects and disciplinary areas, among other factors. It is necessary to collect information from samples that allow generalisation of the results, as well as to pay special attention to how students experienced and continue to experience it (Ali et al., 2022; Dahabiyeh et al., 2022; Suárez-Guerrero et al., 2022).

In particular, it has been identified that much of the body of research uses general burnout scales to measure the socioemotional impacts of confinement (Mosleh et al., 2022), so there is a need to explore results by applying scales specifically constructed and validated in the context of digital fatigue caused by videoconferencing during the Covid-19 pandemic.

The use of digital technologies for entertainment, work, study and communication often leads to information overload, which can result in digital fatigue syndrome for

users. Generally, fatigue is characterised by a feeling of tiredness, lack of energy or exhaustion (Menting et al., 2018). When it comes to digital fatigue, physical discomfort arises from excessive use of digital devices, such as mobile phones, tablets or the computer; this is also often referred to as digital burnout (Sharma et al., 2021). Studies on digital fatigue are not unique to the pandemic and post-pandemic era. Since before the Covid-19 pandemic, which led to the forced shift to remote work and study, there has been talk of the negative effects of staying connected and the relevance of debating the right to digital disconnection (Zamora, 2019).

The construct of digital fatigue can be theoretically understood under the sub-constructs of visual fatigue, social fatigue, motivational fatigue and emotional fatigue (Fauville et al., 2021). Visual fatigue refers to "significant aggravation when an individual has prolonged use of a digital screen, which may even affect the neural networks of the retina" (Kim et al., 2017, p. 391). According to the framework of Fauville et al. (2021) social fatigue refers to the feeling of wanting to be alone, avoiding involvement in social situations. Motivational fatigue is associated with a lack of motivation to initiate an activity, fear of having to do things. Emotional fatigue is described as "the state of feeling overwhelmed, exhausted and used" (Maslach, 2003, p. 2), e.g. emotionally fearful, irritable, moody. Under this frame of reference, it is necessary to investigate the state of students in the pandemic and post-pandemic era in order to build educational scenarios of integral development for all.

The knowledge generated in recent years has been significant in harnessing digital technologies for learning and caring for the socio-emotional state of students. Studies in the context of the Covid-19 pandemic point to digital fatigue "frequently cited as a barrier to student engagement and efficient learning" (Shahrvini et al., 2021, p. 9). Not to mention the high rates of depression, anxiety and stress, institutions and all types of organisations are required to innovate their methods of consultation, care and follow-up for people experiencing these conditions (Rajkumar, 2020). However, digital fatigue and its psycho-pedagogical and socio-emotional consequences can be addressed by reviewing the quality of online classes, accompanying the student in adapting to the use of digital tools, their emotions and connection between teachers and students (McGaughey et al., 2021). In this sense, it is relevant to implement research tools to identify and reduce the difficulties generated by digital fatigue.

Some predictors of digital video conferencing fatigue may be age or gender. Previous studies reveal that "compared to the male gender, women (...) and those who prefer not to disclose their gender (...) had significantly higher videoconferencing fatigue" (Oducado et al., 2021, p. 317), while in terms of age was not taken into account due to low dispersion. Other similar studies, rather than

reporting indicators and effects by gender, tend to focus on understanding young people's uses of technology today; for example, Durmuş et al. (2022) report that digital fatigue is exacerbated by the fact that, in addition to pursuing an academic life online, young people use digital devices for leisure or entertainment more frequently.

Generally, the body of recent studies has reported similar results in students from various areas of higher education knowledge. For example, medical students have been found to suffer from burnout, and the development of resilience was identified to reduce the risks of digital fatigue (Franco et al., 2022). With nursing students, it is inferred that fatigue is relatively prevalent and may be taking its toll on students (Oducado et al., 2021). Meanwhile, the situation with student teachers found that the non-verbal mechanisms of mirror anxiety, the feeling of being physically trapped, hyper-gaze and cognitive load in the production of non-verbal signals were significantly positively related to Zoom fatigue (Moralista et al., 2022). Similar studies with engineering students share that students reported feeling discouragement, boredom, confusion and worry to a greater extent, and calm and confidence to a lesser extent (Baltà-Salvador et al., 2021). Or even a direct correlation between digital fatigue and anxiety has been claimed (Ngien & Hogan, 2022).

Taking into consideration that the virtuality of teaching has caused students to spend long hours in front of the computer connected to different videoconferences, which has started to generate fatigue, anxiety or worry due to the excessive use of these platforms. The aim of this study was to determine the degree of digital fatigue derived from prolonged exposure to videoconferencing systems in university students. In relation to the general objective, the following questions were posed, which guided and structured the research:

RQ1. What was the degree of digital fatigue of university students during the course of their studies in the context of Covid-19?
RQ2. Were there significant differences in the degree of digital fatigue according to the socio-demographic factors of university students?
RQ3. Which socio-demographic variables (gender, age, field of knowledge, hours, electronic device) significantly influenced digital fatigue among university students?

METHOD

A cross-sectional study design (Hernández et al., 2016) was used, based on the application of a self-administered survey in the population of students at the University of Granada, enrolled during the 2021/2022 academic year.

Participant data were collected at a single point in time using Google Forms and the survey was distributed by email. The sampling was by convenience (Cochran & Díaz, 1980), since the entire student community was invited to participate through the internal lists of dissemination of the University. The final sample was made up of those who decided to participate freely.

Participants and procedure

Participants answered questions related to their socio-demographic data and a standardised scale on digital fatigue. Before answering, information was provided about the purpose of the study, the anonymous treatment of the data and the students had to give their informed consent to answer the questionnaire. In addition, the research was approved by the Ethics Committee of the University of Granada (registration number: 1718/CEIH/2020). The data collection period was from November 2021 to January 2022.

Finally, the sample was defined by 488 women and 125 men (n = 613), aged between 18 and 35 years (M = 21.54; SD = 3.85). Table 1 shows the rest of the socio-demographic data of the participants.

Table 1
Socio-demographic data

	n	%
Gender		
Male	125	20.4
Female	488	79.6
Age		
≤ 20	315	51.4
21-35	298	48.6
Field of knowledge of studies		
Arts and Humanities	70	11.4
Science and Health Sciences	86	14
Social and legal sciences	430	70.2
Engineering and Architecture	27	4.4

	n	%
Hours spent daily on videoconferencing systems		
Less than 3 hours	80	13.1
3-4 hours	117	19.1
4-5 hours	168	27.4
5-6 hours	150	24.4
More than 6 hours	98	16
Device used		
Desktop computer	33	5.4
Laptop	524	85.5
Smartphone or Tablet	56	9.1

Note. Age categorisation has been established based on the World Health Organisation (WHO, 2017): less than or equal to 20 years (adolescents) and 21-35 years (young adult).

Data collection instrument

Digital fatigue was assessed using the Zoom Exhaustion & Fatigue Scale (ZEF) (Fauville et al., 2021). The ZEF scale measured five dimensions of fatigue linked to the use of videoconferencing systems: general (items 1-3), social (items 4-6), emotional (items 7-9), visual (items 10-12) and motivational (items 13-15). Thus, in total it consisted of 15 items with a five-point Likert scale response mode ranging from 1 = "Not at all", 2 = "Slightly", 3 = "Moderately", 4 = "Very" to 5 = "Extremely". The scale scores ranged from 15 to 75 points, with higher scores indicating a higher degree of digital fatigue. The ZEF has been used in several studies, showing good psychometric properties and internal consistency (Oducado et al., 2021; Queiroz et al., 2021). For this study, the reliability calculated with Cronbach's Alpha coefficient was good (α = .914).

Data analysis

The different analyses were carried out with the statistical packages IBM SPSS and IBM SPSS Amos, version 25 (IBM Corp., Armonk, NY). Specifically, the statistical-descriptive values of mean and standard deviation were calculated for each socio-demographic factor with respect to the ZEF scale (RQ1). At the same time, the possible existence of significant differences between the sociodemographic factors was analysed with the T test for independent samples when they were dichotomous (gender) and the ANOVA test when more than two groups were established (age, field of knowledge, hours, device) (RQ2).

On the other hand, to answer RQ3, a structural equation model was developed based on path analysis (PA) (Stage et al., 2010). In the PA, the relationships between exogenous variables (gender, age, field of knowledge, hours, device) and endogenous variables (general fatigue, visual fatigue, social fatigue, motivational fatigue, emotional fatigue) were established. However, it was necessary to calculate the univariate and multivariate normality of the data as a preliminary step for the PA. In this sense, univariate normality values were calculated using the Kolmogorov-Smirnov (K-S) test with Lilliefors correction, taking as a reference that the skewness values were less than three and the kurtosis less than 10 as a criterion of data adequacy (Kline, 2005). Multivariate normality was calculated from Mardia's coefficient (Mardia, 1970).

RESULTS

The mean score of the total sample on the ZEF scale was 49.58 (SD = 12.02), placing them in a medium-high degree of digital fatigue. Specifically, for each socio-demographic factor, the statistical-descriptive data and the possible significant differences between them were collected (Table 2). In relation to the gender variable, the highest mean score was found in the group of women (M = 50.94), with significant differences compared to the group of men (p = < .000). On the other hand, in the age variable, the mean scores were similar and no differences were found between the two groups (p = .939).

On the other hand, the mean score in digital fatigue was conditioned by the field of knowledge of the studies taken by the students, where the highest mean score was obtained by those enrolled in Arts and Humanities degrees (M = 55.11), followed by Social and Legal Sciences (M = 49.57), Sciences and Health Sciences (M = 47.81) and Engineering and Architecture (M = 41.15). In addition, significant differences were found between groups (p = .020). With regard to the number of hours dedicated daily to videoconferencing systems, the number of hours was

a determining factor in the average score, with higher scores being achieved by students who dedicated more hours to videoconferencing. In addition, there were significant differences between the number of hours spent (p = <.000). Finally, there were significant differences in the means achieved according to the device used among the students (p = .049), where the highest mean score was with the use of the laptop (M = 50.02), followed by the smartphone or tablet (M = 48.32) and finally the desktop computer (M = 44.85).

Table 2
Descriptive statistics and group differences

	M	DT	*p*
Gender			
Male	44.29	13.08	<.000
Female	50.94	11.37	
Age			
≤ 20	49.55	11.48	.939
21-35	49.62	12.59	
Field of knowledge of studies			
Arts and Humanities	55.11	10.06	.020
Science and Health Sciences	47.81	12.08	
Social and legal sciences	49.57	11.55	
Engineering and Architecture	41.15	16.97	
Hours spent daily on videoconferencing systems			
Less than 3 hours	43.59	14.17	<.000
3-4 hours	45.67	10.94	
4-5 hours	50.16	10.88	
5-6 hours	51.97	10.74	
More than 6 hours	54.51	11.94	
Device used			
Desktop computer	44.85	14.56	.049
Laptop	50.02	11.78	
Smartphone or Tablet	48.32	12.21	

The normality values showed that the skewness showed an asymmetrically negative curve (skewness = -.383). While the kurtosis took a platykurtic distribution (kurtosis = -.080). Thus, the values of skewness and kurtosis were within appropriate values (< 3 and < 10). However, the K-S test with Lilliefors significance correction showed that the data did not follow a normal distribution, as they were at a p-value below .05 (K-S = .059; gl = 611; p = < .000). Although the univariate normality hypothesis was not fulfilled, multivariate normality was confirmed (Mardia = 5.137), where a value of less than p*(p + 2) was obtained, where p was the number of variables observed (in this case it was 15, corresponding to the total number of items in the scale) (Bollen, 1989).

With regard to the goodness-of-fit indices of the PA model, it should be noted that they were adequate according to the criteria established for each of the indices (Byrne, 2013) (Table 3).

Table 3
Goodness-of-fit measures

Index	Values obtained	Values obtained
χ^2	37.4	
df	19	
χ^2/df	1.96	≤3
GFI	.988	≥.90
RMSEA	.040	<.05
NFI	.971	≥.90
CFI	.985	≥.90
AGFI	.966	≥.90
SRMR	.035	<.08

Note. df = degrees of freedom; GFI = goodness-of-fit index; RMSEA = root mean squared error of approximation; NFI = normalised fit index; CFI = comparative fit index; AGFI = adjusted goodness-of-fit index; SRMR = standarized root mean-square.

With regard to PA, connections were established between socio-demographic factors and the different dimensions of digital fatigue. The relationships formed were gender, age and hours with visual fatigue, social fatigue, motivational fatigue and emotional fatigue. At the same time, visual fatigue, social fatigue, motivational

fatigue and emotional fatigue with general fatigue. And finally, device and field of knowledge with general fatigue (Table 4). Significant values were established between gender with visual fatigue, social fatigue, motivational fatigue (p = < .001) and emotional fatigue (p = .007); age with social fatigue (p = .006); hours with visual fatigue, social fatigue, motivational fatigue and emotional fatigue (p = < .001); visual fatigue, motivational fatigue and emotional fatigue with general fatigue (p = < .001); field of knowledge with general fatigue (p = .010).

Table 4
Final model parameter estimates

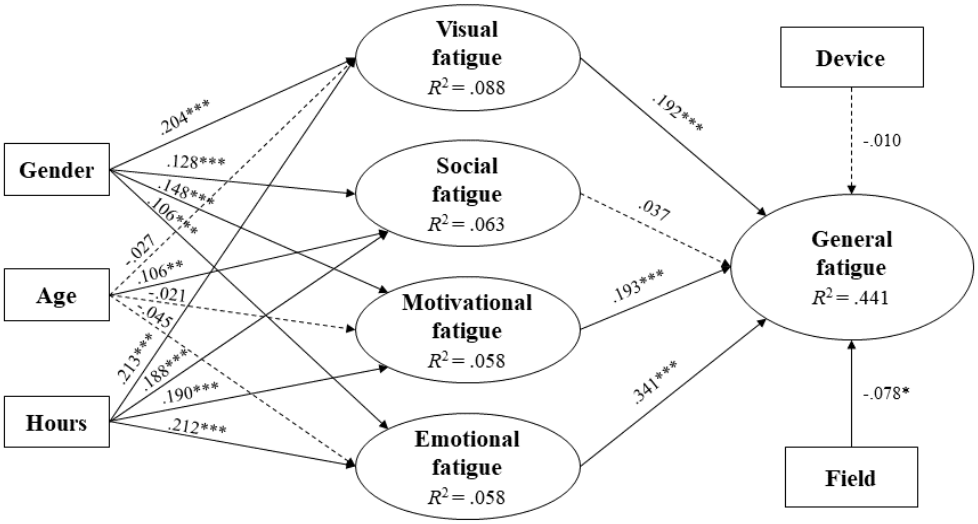
Association between variables	RW	SE	CR	*p*	SRW
Gender → Visual fatigue	1.696	.321	5.278	***	.204
Age → Visual fatigue	-.178	.259	-.687	.492	-.027
Hours → Visual fatigue	.568	.103	5.519	***	.213
Gender → Social fatigue	1.022	.310	3.296	***	.128
Age → Social fatigue	.681	.250	2.722	.006	.106
Hours → Social fatigue	.480	.099	4.838	***	.188
Gender → Motivational fatigue	1.185	.315	3.762	***	.148
Age → Motivational fatigue	-.139	.254	-.546	.585	-.021
Hours → Motivational fatigue	.489	.101	4.850	***	.190
Gender → Emotional fatigue	.844	.313	2.693	.007	.106
Age → Emotional fatigue	-.290	.253	-1.149	.251	-.045
Hours → Emotional fatigue	.541	.100	5.392	***	.212
Visual fatigue → General fatigue	.139	.026	5.431	***	.192
Social fatigue → General fatigue	.028	.028	.988	.323	.037
Motivational fatigue → General fatigue	.144	.030	4.854	***	.193
Emotional fatigue → General fatigue	.257	.033	7.848	***	.341
Device → General fatigue	-.062	.191	-.326	.745	-.010
Field of knowledge → General fatigue	-.166	.064	-2.582	.010	-.078

Note. RW = Regression Weights; SE = Standard Error; CR = Critical Ratio; SRW = Standardised Regression Weights; ***p < .001; n = 613.

The graphical expression of the PA showed the relationship between factors, where the main constructs were visual fatigue, social fatigue, motivational fatigue, emotional fatigue and general fatigue (Figure 1). The significance in the established relationships exemplified the factors that influenced the different dimensions of digital fatigue.

Finally, the percentage of variation for each construct established by the coefficient of determination was 8.8% for visual fatigue (R^2 = .088), 6.3% for social fatigue (R^2 = .063), 5.8% for motivational fatigue (R^2 = .058), 5.8% for emotional fatigue (R^2 = .058) and 44.1% for general fatigue (R^2 = .441).

Figure 1
Path analysis



Note. * Significant at p < .05; **Significant at p < .01; ***Significant at p < .001. Dashed arrow = not significant; n = 613.

DISCUSSION AND CONCLUSIONS

The data collected showed a medium-high degree of digital fatigue in university students due to the continuous use of videoconferencing systems during the pandemic. This may have conditioned students' learning, adding extra difficulties in obtaining a higher grade and adequate development of studies (Ali et al., 2022;

Dahabiyeh et al., 2022; Mpungose, 2021; Penson et al., 2020). Some of the factors to highlight that promote digital fatigue are, among others: the excessive use of the digital screen, the usability of the devices and the fatigue caused by being forced to connect to online classes or having to use the devices to do compulsory tasks. Therefore, the study of the impact of digital fatigue is a highly relevant topic to explain part of the behaviour and conditioning of university students in the Covid-19 pandemic.

As for the significant differences between socio-demographic factors in terms of the degree of digital fatigue, gender was a determining factor showing significant differences, with women having a higher degree of digital fatigue than men. This is in line with previous studies that collected similar data in which women had a higher rate (Oducado et al., 2021). It would therefore be of interest to analyse the cause of such gender differences in further studies.

Another key factor was the field of study, with Arts and Humanities students experiencing a higher degree of digital fatigue. In contrast, previous research has highlighted Health Sciences as the field of knowledge most affected by this phenomenon (Franco et al., 2022; Oducado et al., 2021). Furthermore, depending on the educational institution where the data is collected, the casuistry by field of knowledge may vary depending on the context.

On the other hand, hourly consumption also determined a higher rate of digital fatigue, with students who spent more hours in front of the screen scoring higher. An obvious premise highlighted by authors such as Sharma et al. (2021) was therefore confirmed. In addition, significant differences were also found with respect to the electronic device used, with the laptop in particular standing out as a device associated with a higher prevalence of digital fatigue. It is worth noting, as evidenced by Durmus et al. (2022), that young people use digital devices for leisure and entertainment and not only for academic tasks. As a result, digital fatigue may be exacerbated by the increased number of hours spent in front of an electronic device.

Looking at the impact of socio-demographic variables on digital fatigue, the data showed that gender and number of hours in front of the device were influential factors in visual, social, motivational and emotional fatigue. While age only significantly influenced social fatigue. Furthermore, these three factors were a social determinant of digital fatigue and the socioemotional consequences of wanting to be alone, avoiding involvement in social situations as a consequence of the pandemic (Baltà-Salvador et al., 2021).

Specifically, visual fatigue, motivational fatigue and emotional fatigue were those that had a direct and significant impact on overall fatigue, together with the field of knowledge of the studies taken. These data are in line with the studies by Baltà-Salvador et al. (2021) and Moralista et al. (2022). These four factors determined the

prevalence of digital fatigue in university students, with the negative consequences for their learning that this implies (Rajkumar, 2020; Shahrvini et al., 2021).

It is important to mention that digital fatigue is not unique to the pandemic, but is a problem that has been on the rise in recent years due to the increased use of technology in our daily lives. Although the pandemic has increased the use of video conferencing systems, digital fatigue existed previously and will likely continue to exist in a post-pandemic future.

Finally, the Covid-19 pandemic has led to a significant increase in the use of videoconferencing systems for university education. However, this has led to problems of overexposure to screens and increased mental stress related to information overload and eyestrain. In addition, the lack of face-to-face social interaction and the lack of separation between work and personal space can contribute to feelings of isolation and anxiety. On the other hand, excessive use of videoconferencing has led to difficulties in attention and concentration, which can negatively affect the academic performance of university students. It is important that students, professors and universities take measures to minimise these negative effects, such as setting time limits on videoconferencing and promoting a healthy balance between work and free time.

Specifically, this paper has responded to the objective of determining the degree of digital fatigue derived from prolonged exposure to videoconferencing systems in university students. In addition, a series of research questions of interest to the scientific community have been addressed, where: (RQ1) the degree of digital fatigue of university students has been determined, this average value being 49.58 points; (RQ2) the significant differences between socio-demographic factors have been established according to the degree of digital fatigue, resulting in significant differences between gender (higher score women), field of knowledge (higher score Arts and Humanities), consumption of hours (higher score dedicating more than 6 hours a day to videoconferencing systems, electronic device used (higher score those who used the laptop); (RQ3) the impact of socio-demographic variables on digital fatigue, these being gender and number of hours spent on videoconferencing systems for visual fatigue, social fatigue, motivational fatigue and emotional fatigue; age for social fatigue; visual fatigue, motivational fatigue, emotional fatigue and field of knowledge of studies pursued for general digital fatigue.

The limitations of the study are the limited sample size in some sectors of the population, where in some of them there is a sample imbalance with respect to others. However, in terms of representativeness, the sectors with the largest sample are representative of the total number of students at the University of Granada. In this case, enrolments in the Social and Legal Sciences field are more numerous and the representation of women is higher than that of men, for example in degrees such as those related to Education. Another limitation is that the study was conducted at

a single educational institution, so the results are not necessarily generalisable to other university students at different institutions. In addition, the sample consists of undergraduate students from a single university, aged 18-35 years, which limits the generalisability of the results to other populations, such as undergraduates of other ages or students in secondary education. Nevertheless, this study provides valuable information on digital fatigue in university students during the Covid-19 pandemic, but the aforementioned limitations should be kept in mind when interpreting and generalising the results.

From this study, several lines of research could be proposed to further explore the issue of digital fatigue in university students:

- Conduct longitudinal studies assessing digital fatigue in university students over time, which would determine how digital fatigue evolves and how it is related to the continuous use of videoconferencing systems.
- Conducting similar studies in different educational institutions would allow us to determine whether the results are generalisable to other university students in different contexts and regions.
- To investigate how digital fatigue affects the academic performance of university students and how it relates to the continuous use of videoconferencing systems.
- To find out what strategies are effective in reducing digital fatigue in university students and how they can be implemented in the classroom and at home.

In short, this paper gathers data of interest to the scientific community regarding the prevalence of digital fatigue in university students and the significant and influential factors in it. Aspects that are essential to know in order to alleviate the risk of digital fatigue and solve a problem that has been established in higher education institutions, being common in the case of students due to the necessary use when learning online or in blended learning format.

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Impact of the Covid-19 pandemic on teacher tweeting in Spain: needs, interests, and emotional implications

El impacto de la pandemia de Covid-19 en los tweets de los profesores en España: necesidades, intereses e implicaciones emocionales

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ABSTRACT

The dissemination of Covid-19 imposed the confinement of a large part of the world's population. For this reason, face-to-face classes in Spain were interrupted and did not resume until September 2021. The situation forced schools to move both teaching and communication between teachers to a digital environment, which favoured greater use of social networks. This paper conducts an exploratory study of 30751 tweets extracted from eight educational hashtags (#eduhora, #claustrovirtual, #SerProfeMola, #otraeducaciónesposible, #claustrotuitero, #profesquemolan, #orgullodocente, and #soymaestro) used by the educational community of teachers in Spain. A semantic content analysis is carried out using a mixed methodology based on public data mining and sentiment analysis. The analysis of the data provided novel information about the needs,

interests and concerns, as well as the emotional implications that teachers expressed on the social network Twitter during the transition to virtual teaching. The lock-in situation was associated with increased emotional content in the tweets analysed in the sample, irrespective of the positive, negative or neutral polarity of the tweets. The results also show that teachers in Spain use social networks both for professional development and emotional support and that this trend has increased after Covid-19. The use of Twitter is linked to continuous professional development in times of particular difficulty, also in Spain, as has been the case in other countries. The findings of the study show that the historical Twitter archive is a valid resource for the analysis of teachers' feelings in longitudinal research including the Covid-19 period.

Keywords: Twitter, Covid-19, teachers, professional development, content analysis

RESUMEN

La difusión del Covid-19 impuso el confinamiento de gran parte de la población mundial. Por este motivo, en España las clases presenciales se interrumpieron y no se reanudaron hasta septiembre de 2021. La situación obligó a los centros educativos a trasladar tanto la docencia como la comunicación entre el profesorado a un entorno digital, lo que favoreció un mayor uso de las redes sociales. Este trabajo realiza un estudio exploratorio de 30751 tweets extraídos de ocho *hashtags* educativos (*#eduhora, #claustrovirtual, #SerProfeMola, #otraeducaciónesposible, #claustrotuitero, #profesquemolan, #orgullodocente, y #soymaestro*) utilizados por la comunidad educativa de profesores en España. Se realiza un análisis semántico de contenidos que utiliza una metodología mixta basada en la minería de datos públicos y el análisis de sentimientos. El análisis de los datos proporcionó información novedosa sobre las necesidades, los intereses y las preocupaciones, así como las implicaciones emocionales que el profesorado expresó en la red social Twitter durante la transición a la enseñanza virtual. La situación de encierro se asoció con el aumento del contenido emocional en los tuits analizados en la muestra, independientemente de la polaridad positiva, negativa o neutra de los mismos. Los resultados muestran también que el profesorado en España utiliza las redes sociales para el desarrollo profesional y el apoyo emocional, y que esta tendencia ha aumentado después del Covid-19. El uso de la red social Twitter se vincula con el desarrollo profesional continuo en momentos de especial dificultad en España, al igual que ha sucedido en otros países. Las conclusiones del estudio ponen de manifiesto que el archivo histórico de Twitter es un recurso válido para el análisis de los sentimientos del profesorado en investigaciones longitudinales que incluyan el periodo de Covid-19.

Palabras clave: Twitter, Covid-19, profesorado, desarrollo profesional, análisis de contenido

INTRODUCTION

Covid-19 has had very negative effects on education globally and has presented very complex challenges in this area (Harris, 2020; Rehm et al., 2021). However, the review of the literature on the impact of the Covid-19 pandemic on teaching and learning suggests that the pandemic provides an opportunity to pave the way for the introduction of digital education (Pokhrel & Chhetri, 2021).

In the case of Spain, several studies describe the negative effect on teachers of the confinement of the entire Spanish population between March and June 2020, and the suspension of face-to-face classes until September 2021.

Online communities have been proved to be a very effective tool for communication between teachers (Rehm et al., 2021). Trust et al. (2016) defined an online community as a network where individuals share practice-based knowledge. Research by Greenhow et al. (2021) and Xing and Gao (2018) suggests that online teachers' communities have increased worldwide during the global pandemic of Covid-19 in response to new educational challenges.

Participants in the study by Trust et al. (2016) described professional learning networks for teachers as diverse and multifaceted networks of people, communities, tools, platforms, resources and sites. They also highlighted the affective, social, cognitive and identity benefits of the experiences.

Twitter provides a social networking platform for the voluntary online professional teaching activities. After an exhaustive review of the literature on the topic, Carpenter and Krutka's (2015) survey showed that for many teachers Twitter facilitates positive, collaborative professional activities and helps combat various forms of isolation. Subsequent research (Trust et al., 2020; Xing & Gao, 2018) describes the strong interest of educators in participating in social networking communities such as Twitter but also the different approaches used by scientific literature to study this phenomenon.

From another perspective, Nochumson (2020) suggests that Twitter may have a strong value as a legitimate platform for lifelong learning and for keeping teachers in the profession.

Research on Twitter has often turned to educational hashtags to analyse how teaching communities have used social media (Greenhalgh et al., 2021). Carpenter et al. (2020) analyse educators' activity on more than 2.6 million tweets posted using 16 education-related hashtags. Their study demonstrates that Twitter hashtags aid the exchange of ideas, organisation, activism, leadership and the development of social capital by educators.

Undoubtedly, the most studied educational hashtag in the literature is #Edchat (Gao & Li, 2017; Willet, 2019). For example, Greenhow et al. (2021) analyse over half a million tweets with this hashtag during the pandemic to remotely investigate

the transition to emergency teaching. Willet (2019) uses Carpenter and Krutka's (2014) survey on how and why educators use Twitter to analyse over 1.2 million #Edchat tweets. Their data suggest that this social network was preferentially used to explore ideas and share feelings.

Semingson and Kerns (2020) and Trust et al. (2020) use #remoteteaching and #remotelearning to analyse teacher activity during Covid-19. Both hashtags were used to share pedagogical resources and receive online support also in Spain (Beardsley et al., 2021). Rosell-Aguilar (2018) concludes that the #MFLtwitterati hashtag itself constitutes a virtual community of language teachers both in terms of the profile of the hashtag users and the practices and beliefs presented. Parrish and Martin (2022) reached a similar conclusion with the #MTBoS hashtag for mathematics teachers. Educational Twitter hashtags in languages other than English have also been used for educational research. For example, Greenhalgh et al. (2021) in France, Gómez and Journell (2017) in Spain and Zhou and Mou (2022) in China.

Teachers' communities use Twitter to share content related to their professional activity (Carpenter & Krutka, 2015; Luo et al., 2020) and to express emotional content (Carpenter et al., 2020). The most frequent themes reported in the literature are: asking and answering questions; sharing and finding teaching-related resources; reflection; dialogue; and emotional support (Galvin & Greenhow, 2020). Since Covid-19 the most popular topics requested by teachers on Twitter were related to online learning (Greenhow et al., 2021), the use of educational technology and teaching resources (Rehm et al., 2021).

Recent research on teacher communities gathered around educational hashtags has been based on Gee's (2017) concept of affinity space applied to Twitter for educators (Carpenter et al., 2021; Greenhalgh et al., 2020). Public relations established on Twitter have been described in detail in previous research (Sailunaz & Alhajj, 2019). For example, Greenhalgh et al. (2020) analyse teachers' interactions through a specific hashtag based on likes, retweets, replies and mentions.

Emotional content in educational research has been related to online teaching, professional development and educational communities (Arora et al., 2021). Emotional content analysis is performed using Sentiment Analysis (SA), also called Opinion Mining. Although there are several methods to perform this analysis, Machine Learning-based sentiment analysis is the most widely used for this purpose in educational research (Zhou & Ye, 2020), especially in the Spanish-speaking context (Osorio et al., 2021). The study by Harron and Liu (2022) demonstrates that the Twitter historical archive is a valid resource for teacher sentiment analysis in longitudinal research that includes the Covid-19 period.

A very promising scope for sentiment interpretation on Twitter is the analysis of emojis (Li et al., 2022); but we have not found significant educational research applying visual sentiment analysis. Previous studies have demonstrated the

effectiveness of this method in informal Spanish-language texts (Fernández-Gavilanes et al., 2018).

PURPOSE AND RESEARCH QUESTIONS

The study presented here expands on the knowledge available to date on the role of Twitter as a social network and a space for teacher interaction before and after Covid-19. The pandemic marks a before and after in educational environments, moving the teaching-learning processes from a physical space such as the classroom to a virtual space such as online learning. Although several studies have explored the activity of teachers on Twitter, few have compared this activity before and after the pandemic. Thus, we sought to understand the influence of the pandemic on teachers' use of the social network Twitter, as well as to determine changes, if any, in activity, topics of interest, interactions and feelings. We did this by answering four research questions:

RQ1. How did Covid-19 impact teachers' Twitter activity?
RQ2. What topics did teachers tweet about before and after Covid-19?
RQ3. How did teachers interact on Twitter before and after Covid-19?
RQ4. How did teachers' feelings on Twitter evolve before and after Covid-19?

METHOD

This study uses digital data retrieved from social media platforms, in this case specifically Twitter (Greenhalgh et al., 2021; Kimmons & Veletsianos, 2018). We selected the social network Twitter because it is the most widely used by teacher education communities (Luo et al., 2020). We used a mixed methodology based on public data mining and sentiment analysis. This methodology involves the use of digital crawling data in order to more effectively collect, organise and analyse generalisable samples of data representing people in virtual learning and communication environments (Kimmons & Veletsianos, 2018).

Data collection

Using the Twitter v2 API, we collected 18,129 tweets with the hashtags #eduhora, #claustrovirtual, #SerProfeMola, #otraeducaciónesposible, #claustrotuitero, #profesquemolan, #orgullodocente, and #soymaestro, from 1 March 2020 to 31 March 2022 (hereafter referred to as "After Covid-19"). In Spain, these dates cover the periods of confinement, state of alarm and new normality. To compare how teachers' Twitter

engagement in Spain may have changed, we also collected 12,622 tweets with the same hashtags posted between 1 January 2018 and 28 February 2020 (hereafter referred to as "Before Covid-19"). For the analysis of the tweets, punctuation marks and unnecessary characters were removed from the JavaScript Object Notation (JSON) encoding of the Twitter API. Our final dataset included 30,751 tweets along with associated metadata as evidence of an interaction.

Data analysis

To answer the first research question, we calculated the monthly count of all tweets posted before and after Covid-19.

To answer the second research question, we conducted a content analysis of tweets in each of the study periods (Carpenter et al., 2020).

This analysis aimed to determine whether there are differences in the topics discussed by teachers before and after Covid-19 (Gao & Li, 2017). To do so, we performed a semantic content analysis (Neuendorf, 2017) based on public data mining (Kimmons & Veletsianos, 2018). We identified keywords in each of the periods of the study with Sketch Engine (SE), which was considered appropriate due to its ability to process natural languages and its exploratory nature (Del Olmo & Arias, 2021). Specifically, we used the keyness parameter to measure the relevance of the topics in each of the two corpora (Firoozeh et al., 2020). Keyness measures the "statistical significance" of terms concerning a reference corpus of 16 billion SE "Spanish Web 2018" words (Firoozeh et al., 2020): words with a high value in this parameter provide the representation of socially important concepts in the sample (Scott, 1997).

To answer the third research question, we first analysed the metadata associated with the public metrics of the Twitter v2 API as evidence of an interaction. We performed a descriptive statistical analysis of the interactions by month. Next, we conducted a qualitative analysis of the content of each of the tweets published during the months in which an increase in retweets, replies and likes was detected; to do that, the qualitative analysis software Atlas.ti (v.9) was used to extract the most significant examples. Previous categories were determined that coincident with the topics identified with SE within the second research question. This analysis was also used in response to RQ4.

To answer the fourth research question, we first performed Sentiment Analysis (SA) with Google's Natural Language API, which rated the emotional content of each tweet on a scale between -1 and +1. Following the formula validated by Quintana-Gómez (2021), we converted these data into a text label and considered a positive sentiment polarity for the values collected between 1 and 0.3, a neutral polarity between 0.2 and -0.2, and a negative polarity between -0.3 and -1. Next, we

performed a sentiment analysis on the visual data. For this purpose, we identified the most frequent emojis in the sample (Fernández-Gavilanes et al., 2018) and related them to SA.

RESULTS

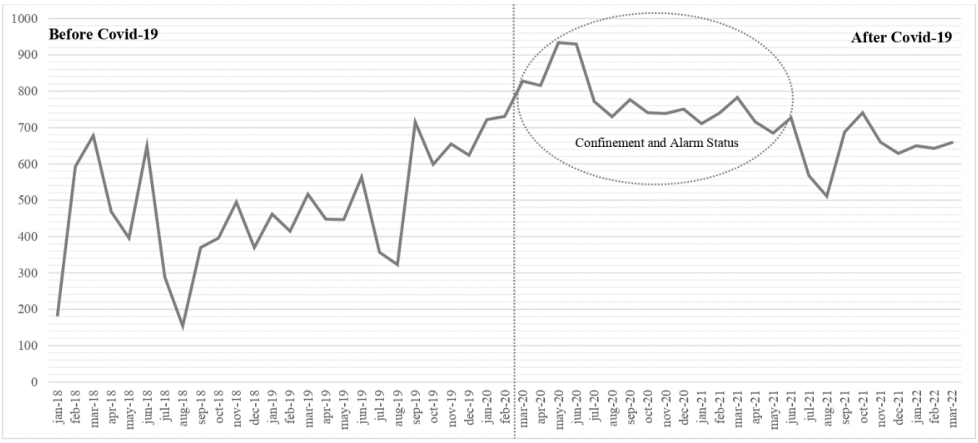
RQ1. How did Covid-19 impact teachers' Twitter activity?

The results show a significant increase in teacher activity on Twitter during Covid-19 (Figure 1), accentuated during the confinement period between March and June 2020. This increase coincides with the closure of schools in Spain and the generalisation of online teaching. This trend becomes more nuanced after the lockdown period; in the subsequent period, which we have termed the State of Alarm period (between July 2020 and May 2021), teacher activity on Twitter considerably decreased. After the alarm period, teachers' Twitter usage returns to December 2019 levels.

The partial drop-in activity during the quarter of June, July and August is insignificant because it coincides with the school summer holiday period in Spain. Despite this, Twitter activity during the holiday quarter throughout confinement was higher than during school holidays in the rest of the periods analysed.

Figure 1

Teachers' activity on Twitter during Covid-19



RQ2. What topics did teachers tweet about before and after Covid-19?

To determine the relevance of the topics that teachers posted on Twitter before and after Covid-19, we used the SE keyness score. Only topics with a keyness value higher than 150 were estimated. Based on these results, we have identified eight topics: 3 topics before Covid-19 and 5 topics after Covid-19 (Table 1). Our analysis suggests that in both periods there is a repeated interest in new learning techniques such as flipped classroom, gamification or cooperative work, and in technological resources such as Genially or Canva.

Before Covid-19, teachers tweeted to find and share new learning methodologies and techniques (Topic 1), as well as educational technology for e-learning (Topic 2). We also found that teachers of subjects such as mathematics and religion were the most active on Twitter before the pandemic (Topic 3). After Covid-19, there was continued interest in topics related to free digital resources for the classroom (Topic 1), and new models of e-learning (Topic 2).

Keywords extracted with SE allowed us to identify the most relevant technological tools in this period for teachers in Spain: Genially; augmented reality; Apple Education; Wakelet; Flipgrid; Quiz; Canva; Webinar; Tinkercad; Twitch; Edpuzzle; YouTube; Educaplay; Kahoot; Additio; Moodle; Eduzland; Spreaker; Instagram; and Google Classroom. Before the pandemic, fewer and significantly less relevant resources were listed: Genially; Storify; Wakelet; Apple Education; and Canva.

Our results suggest an increased activity by Spanish teachers of school subjects such as languages, natural sciences and social sciences, in addition to the interventions of mathematics and religion teachers that were already present before the Covid-19 period (Topic 4).

In this period, two new topics directly related to the pandemic appeared. First, a topic related to distance education, e-learning and virtual classrooms (Topic 3). Next, teacher concerns linked to the coronavirus appeared (Topic 5); this topic is strongly linked to emotional content. For example, during the lockdown, teachers tweeted about wearing masks and the importance of staying at home, and the de-escalation afterwards was about the new normal and the safe return to face-to-face classes.

Table 1

Topics generated by SE analysis based on the keyness score

Topic	Terms under each topic	*Keyness Score*
	Before Covid-19	
1	Flipped; flippedclassroom; flippedprimary; gamification; gamifyyourclassroom; visualthinking; cooperativework; Montessori	858.941
2	Genially; canva; edtech; storify; wakelet; augmentedreality; virtualreality; appleedu; educacion3.0; educaintef; kahoot; microsofteduesp	417.268
3	Mathematics; mathteam; mathblogs; visualmath; ilovemaths; teachmath; mathpage; simplifiesmath; religion; religionclass; innovatesreligion; edufis; historytopics; frenchuptoyourthroat; edmusical	252.938
	During Covid-19	
1	Genially; flipeacgenially; canva; spreaker; edtech; wakelet; augmentedreality; moodle; eduzland; teachingtwitch; additioapp; digitisation; educaplay; kahoot; googleworkspace; googleclassroom; twitch; twitches; twitchteachingstaff; youtube; tiktok; edutwitter; tinkercad; edpuzzletips; quiz; quizs; quizizz; appleeduchat; appleedu; flipgrid; padlet; educaintef	764.704
2	Flipped; flippedclassroom; flippedprimary; flippedlearn; flippedlearning; gamify; gamification; gamificator; gamifying; gamifyyourclassroom; escaperoom; visualthinking; cooperativelearning; learningbyplaying	484.149
3	Distanceeducation; elearning; virtualclasses; blendedlearning; onlinelearning; videocall; camera; microphone; teleworking; videoconference; onlineclasses; virtualclasses; virtualclassroom; webinar; webinally; distancelearning; onlineeducation	353.915
4	Mathematics; mathteam; maths4everthink; religion; religionclass; beingareligionteacheriscool; environmentaleducation; radiohistory; historytopics; grammar; readingandwriting; physicaleducation; edmusical; naturalsciences; eduphys; English; music	321.373

Topic	Terms under each topic	*Keyness Score*
	During Covid-19	
5	Covid; Covid-19; coronavirus; pandemic; quarantine; quarantine; confinement; mask; hometeachers; hometeaching; stayathome; backtosafecollege; returnsafely; new normal; deescalation	167.023

RQ3. How did teachers interact on Twitter before and after Covid-19?

Teachers can interact with Twitter in four different ways: reading, replying (reply), sharing (retweet), or mentioning that they like a tweet. In this study, we were unable to analyse the number of users who read each tweet because this data is not available in the public metrics of the Twitter API. Replies were the least frequent, both before and after Covid-19. Before Covid-19, the months that accumulated the highest number of replies were June 2019 (7.2%), August 2019 (6.3%) and February 2020 (5.8%). In the period after confinement, the months with the highest rate of replies were August (4.8%) and September (6.1%) 2020, and March 2022 (5.7%) (Tables 2 and 3).

Retweets increase considerably in some months. The first highlight occurs before Covid-19, specifically in March 2018 (Table 2). The most retweeted tweet (4915 retweets in March 2018) was posted by @Profe_RamonRG and dealt with the importance of qualitative assessment, highlighting the importance of the students' qualities and emotional education. The second highlight appears after Covid-19, specifically in the months of confinement and state of alarm (Table 3).

Table 2
Interactions before Covid-19

	Retweets		Replies		Likes	
	f	%	*f*	%	*f*	%
jan-18	1004	1.3	170	0.9	2845	1.0
feb-18	4791	6.3	453	2.5	5802	2.1
mar-18	8351	11.0	827	4.5	18845	6.9
apr-18	1816	2.4	357	1.9	5635	2.1
may-18	2112	2.8	315	1.7	5416	2.0
jun-18	4132	5.4	444	2.4	7227	2.6
jul-18	1905	2.5	308	1.7	5834	2.1
aug-18	960	1.3	230	1.2	3649	1.3
sep-18	2659	3.5	529	2.9	9406	3.4
oct-18	2322	3.0	468	2.5	8031	2.9
nov-18	2774	3.6	726	3.9	10971	4.0
dec-18	2653	3.5	516	2.8	9811	3.6
jan-19	1966	2.6	686	3.7	8780	3.2
feb-19	3199	4.2	727	3.9	13115	4.8
mar-19	2484	3.3	1014	5.5	10932	4.0
apr-19	3387	4.4	895	4.9	14269	5.2
may-19	2627	3.5	745	4.0	10348	3.8
jun-19	4666	6.1	1331	7.2	20438	7.5
jul-19	1564	2.1	669	3.6	8853	3.2
aug-19	1700	2.2	1159	6.3	9139	3.3
sep-19	2808	3.7	948	5.1	13261	4.8
oct-19	3119	4.1	868	4.7	13718	5.0
nov-19	3320	4.4	886	4.8	13608	5.0
dec-19	3183	4.2	1058	5.7	13968	5.1
jan-20	3342	4.4	1029	5.6	14996	5.5
feb-20	3288	4.3	1076	5.8	14647	5.4
Total	76132	100.0	18434	100.0	273544	100.0

Table 3
Interactions after Covid-19

	Retweets		Replies		Likes	
	f	%	f	%	f	%
mar-20	3939	4.3	1434	4.4	16925	3.6
apr-20	4847	5.2	1564	4.9	22094	4.6
may-20	4057	4.4	1378	4.3	18532	3.9
jun-20	6360	6.9	1719	5.3	29383	6.2
jul-20	6210	6.7	1367	4.2	23468	4.9
aug-20	7153	7.7	1558	4.8	28711	6.0
sep-20	4963	5.4	1960	6.1	26518	5.6
oct-20	2945	3.2	1033	3.2	17628	3.7
nov-20	4960	5.4	1255	3.9	20331	4.3
dec-20	1758	1.9	1254	3.9	12724	2.7
jan-21	3328	3.6	1251	3.9	18067	3.8
feb-21	2638	2.8	920	2.9	13830	2.9
mar-21	2901	3.1	1253	3.9	15498	3.3
apr-21	3019	3.3	1170	3.6	16844	3.5
may-21	3544	3.8	1112	3.4	16264	3.4
jun-21	2678	2.9	1083	3.4	17105	3.6
jul-21	1641	1.8	972	3.0	9823	2.1
aug-21	2050	2.2	981	3.0	11229	2.4
sep-21	3091	3.3	1351	4.2	17183	3.6
oct-21	3313	3.6	1209	3.7	18715	3.9
nov-21	3048	3.3	1003	3.1	13704	2.9
dec-21	2207	2.4	1227	3.8	13730	2.9
jan-22	4442	4.8	1174	3.6	25233	5.3
feb-22	3411	3.7	1174	3.6	25233	5.3
mar-22	4099	4.4	1840	5.7	27745	5.8
Total	92602	100.0	32242	100.0	476517	100.0

The qualitative analysis with Atlas.ti of the content of the most retweeted tweets in this highlight shows that they are related to the exchange of teaching resources in the digital space, but also to the consequences of the pandemic and the school conditions that will exist when the pandemic allows a return to the classroom (Table 4). These issues coincide with the topics found in response to research question 2 for this period.

Table 4

Examples of the most retweeted tweets

	Retweets	Examples
Topic 1	621	I provide you with a simple and practical step-by-step tutorial of Google Classroom, already implemented with my kids. Made with love and humility. It also includes examples and ideas that you may find useful. A big hug #claustrovirtual https://t.co/Q1gVDlHH2t Keep going team!
	139	Hello #claustrovirtual! As video calls may continue next school year, I share with you this #visualthinking, a guide for students on how to participate in a videoconference. cc @imgende, @ladeidiomas, @carmeniglesiasb. More information at https://t.co/FLFG5TOROY https://t.co/jvgCjSBNxf
	125	Hello, #claustrovirtual, I leave you the link of @wakelet with a compilation of tools for #teachingonline, #teachingvirtual or simply to enrich your classes. The list keeps growing. I hope you find it useful. #CD0 https://t.co/frgOUCyvGZ https://t.co/97t8VrIQV7
	116	7 ICT tools to create comics in a simple way. Applications and generators so that students can make their own comics. Here are the tools and their links @genially_es. #VirtualCollege #comics https://t.co/0nxgeiMwKU https://t.co/ZhIVw7JiVI
	113	A few months ago I uploaded some tutorials on how to create a digital diary and some of you like mine as it is, so I leave you the direct download link to use in Apple Notes or @GoodNotesApp https://t.co/CCzIkkk1Ax #claustrovirtual #claustrotuitero
	92	I was just given a workshop on @edpuzzle and I confirm that it is one of my indispensable tools. I leave you a manual in Spanish to use this valuable tool #claustrovirtual #edtech #teachers @imgende @ProfeCarlos67 @ladeidiomas @somprojecte https://t.co/hwa5RTn382 https://t.co/pI6iLLNX56

Topic 2	424	Ms Minister @CelaaIsabel. We understand that the situation is terribly complex, that finding a solution is very difficult. Please let us help you, listen to the teachers. We know the reality of the classroom and we have a lot to contribute. You can count on us. Thank you. #soyMaestro
	208	The children, the great forgotten ones. They took on the strictest confinement, were the first to stay at home and the last to go out. I hope they are now the first to be thought of, providing them with measures for a safe and secure return to school. #soyMaestro
	182	A devastating health crisis. A terrible economic crisis. Let us not add an education crisis, please. Dear leaders, let us work on real and concrete solutions, but let us do it together. We teachers will be happy to contribute ideas. Here we are. #soyMaestro
	135	Today, nothing can replace the classroom. Education, especially with the youngest children, is about coexistence, about looks and gestures of complicity, about sitting next to them and explaining it to them as many times as necessary, about playing, about feeling, about living. Hopefully. #soyMaestro
	105	The 4M rule. Mask. Clean hands. Two meters. Look how simple it is!!! #soyMaestro
	103	We all want and need schools to be open in September. The hope for that to happen is to get the virus under control, and for that there is a way: masks, distances, hand hygiene. Let's fight together to keep hope alive. Let us make it happen. #soyMaestro

Finally, likes (which is another way for teachers to interact and take interest in their colleagues' contributions) have increased significantly in the months following confinement (Figure 2). The most retweeted tweets also accumulate more likes, so retweets and likes have a direct relationship.

RQ4. How did teachers' feelings on Twitter evolve before and after Covid-19?

To answer the fourth research question, we first performed SA (figure 3). The results show a positive polarity of the emotional content in 64.3% (n=19784) of the tweets analysed; 33.6% (n=10340) of the tweets have neutral emotional content; finally, only 2.1% (n=627) of the total sample have negative result in the sentiment analysis.

Figure 2

Retweets, replies and likes before and after Covid-19

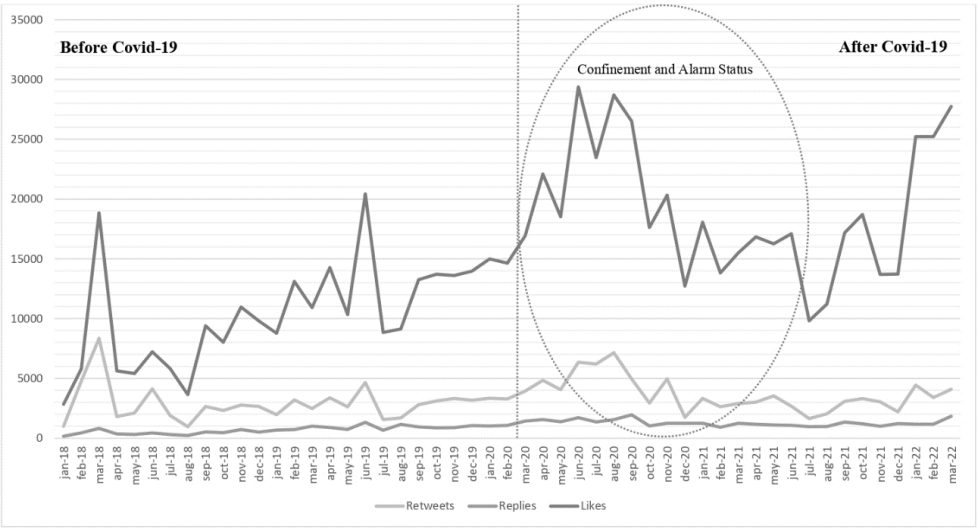


Figure 3

Google's Natural Language API SA results

Negative								Neutral					Positive							
-1	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
0	0	1	1	21	81	201	322	456	672	2350	2636	4226	3623	2708	2302	2176	2109	2717	4149	0
627								10340					19784							
30751																				

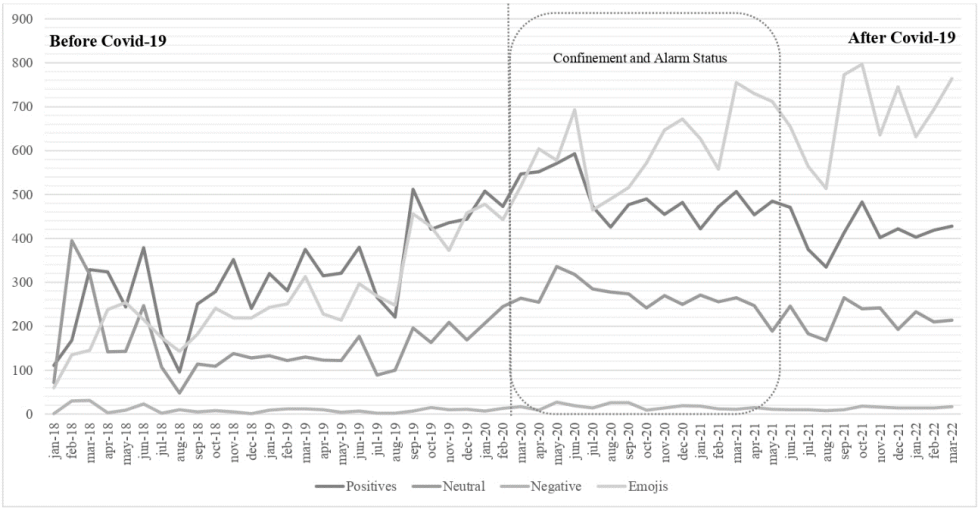
After Covid-19, our analysis shows a very significant increase in the emotional content of tweets, around 20% more than in the pre-pandemic period (table 5). This increase is independent of sentiment polarity and is found in tweets with positive, negative and neutral emotional content. Sentiment polarity is similar in the two periods, although emotional content is intensified.

The visual SA analysis of the sample resulted in the use of a total of 1089 different emojis. Of these 1089 emojis, only 29 of them appeared with a repetition of more than 100 times, predominantly emojis with a positive emotional charge, as classified by Fernández-Gavilán et al. (2018) and Chen et al. (2018). The comparison by period is consistent with the sentiment analysis above. The emotional content of tweets reflected in emojis increased in the post-Covid-19 period, with a particular incidence of emojis expressing positive sentiment (Figure 4).

Table 5
Sentiment polarity before and after Covid-19

Study period	Negative		Neutral		Positive	
	f	%	*f*	%	*f*	%
Before Covid-19	249	39.7	4146	40.1	8227	41.6
After Covid-19	378	60.3	6194	59.9	11557	58.4
Total	627	100.0	10340	100.0	19784	100.0

Figure 4
SA and emojis before and after Covid-19



Qualitative content analysis with Atlas.ti identified four themes in tweets with positive sentiment polarity and five themes in tweets with negative sentiment polarity.

The themes linked to positive feelings are related to autonomous learning (*Especially the teachers, who have been able to adapt to this challenge of teleteaching, even with all the difficulties encountered, have been and are still there at the helm*), the development of digital competences (*By the way, I am not an isolated case. Like me, thousands of teachers are giving digital competence a go these days*), and the acquisition of resources for the classroom (*I'm thinking of getting an #instagram account as a teacher to find even more resources. Would you recommend it?*).

Tweets related to the commitment of the education community also show positive sentiments (*It was teachers, students and their families who saved education, once again. Others will claim medals, and we give them away, because we never did it for medals, we are driven by an unwavering commitment to our students. That is how it has always been*).

The tweets with negative sentiments were about frustration with the difficulties of online teaching (*After another hard week full of difficulties, after the anguish of seeing how they keep getting confined every day, and with the terrible wear and tear of it all, getting to Friday means too much. Hopefully this weekend will repair some of the damage*), the lack of technological resources (*What about those thousands of teachers who don't have Google Classroom, Moodle, Teams and other private or official platforms? I keep seeing talks, webinars, meetings... and I don't hear anyone talking about this other reality*), as well as problems related to the use of digital platforms (*Not with your data (or mine), privacy in times of pandemic and beyond. Are teachers aware of the responsibility to comply with the RGDP? And what about management teams, families and students?*).

Finally, the political management of education in the pandemic is associated with very negative feelings (*Since the minister does not say it, I will say it: thank you #claustrovirtual, to my future colleagues, for having adapted to the situation autonomously, without indications or help*) (*The equation is simple if you have the will. But it is easier to leave the problem to teachers. It would not be unusual for them to take advantage of the autonomy of the school, without giving resources. Then, if it goes wrong, it is because we teachers are not trying hard enough*).

DISCUSSION

This study examined how teachers in Spain tweeted and the impact Covid-19 had on this activity. The results provide information on the activity generated, the professional interests, needs and concerns, as well as the emotional or sentimental load that has been generated before and during Covid-19. We interpret these results by linking them to the existing literature in terms of flexible teachers' community, continuous professional development and emotional support network.

Flexible teachers' community

Twitter is an open and flexible space where you can interact at any time, from anywhere, as many times as you want. Our study provides new insights into the flexibility and adaptability of this social network as a space for teacher interaction,

especially when teachers share and search for online resources, which is in concordance with Greenhow et al. (2021) study.

The freedom of access to flexible teacher communities on Twitter is evidenced by the increase in teacher tweets during the period of lockdown and state of alarm due to Covid-19 and the subsequent decrease in activity. Even during the school holiday period of the lockdown in Spain, teachers used Twitter more than in other years. This phenomenon has been extensively described in the literature in other countries. It is related to the uncertainty produced by school closures and the transfer of teaching-learning processes to the digital environment (Greenhow et al., 2021; Trust et al., 2020).

Our data also showed changes in how teachers interacted in teacher networks on Twitter after Covid-19. In particular, many teachers retweeted other interventions as a way of sharing content, with a notable increase during confinement in Spain. The possibilities of interacting on Twitter (beyond writing tweets) allow not only to develop the network but also to keep it active (Carpenter & Krutka, 2015; Carpenter et al., 2020).

Furthermore, our findings show how the content of interest to teachers changed according to the global context. Thus, as of March 2020, teachers in Spain tweeted to request and share digital resources to facilitate teaching in the new educational space (Zhou & Mou, 2022).

New themes emerged concerning virtual teaching and health measures to ensure a safe return to the classroom. This suggests a change in teachers' needs and interests that was immediately reflected in teachers' Twitter chats. Our findings show that a flexible network of teachers grouped around educational hashtags has formed in Spain, accessible at any time and from anywhere (Galvin & Greenhow, 2020; Greenhow et al., 2021), which adapts to new contexts quickly (Trust et al., 2016).

Continuous professional development

The literature has shown that Twitter is a social network that teachers use to collaborate, share experiences, train and establish new professional contacts (Carpenter & Krutka, 2015; Galvin & Greenhow, 2020; Greenhow et al., 2021; Willet, 2019). Our study has evidenced that teachers used Twitter to support their professional development, sharing and requesting digital resources that will help them reorganise online teaching caused by Covid-19. We agree with the study by Greenhow et al. (2021) that one of the reasons teachers use this social network is to overcome the limitations of local environments.

Since Covid-19, professional development through teacher communities on Twitter has increased very intensively in Spain. For example, our results show a

five-fold increase in interest in technologies related to online teaching, and the sharing of programmes, tutorials, recorded lectures, etc. In particular, during the confinement in Spain, technological tools such as Genially, Wakelet, Flipgrid, Quiz and Canva, among others, were very relevant. This suggests a tendency to consider new ways of teaching as a result of the restrictions derived from the closure of schools (Rehm et al., 2021).

Our results identify a topic related to teachers' professional activity that is not found in the literature. This is the teachers' interest in occupational safety from Covid-19, which expresses concern on Twitter about a safe return to face-to-face teaching, access to face masks and the conditions of confinement. This issue has been studied extensively in other fields such as health (Menon et al., 2020; Michaels & Warners, 2020), but has not generated studies in the field of education.

Emotional support network

Our study shows that teacher communities on Twitter constitute a highly effective emotional support network. Our results revealed that teachers in Spain tweet and share positive emotional content before and after Covid-19, which is consistent with previous studies (Arora et al., 2021; Fernández-Gavilanes et al., 2018). The confinement situation was associated with increased emotional content in teachers' tweets, regardless of the positive, negative or neutral polarity of the tweets. These results disagree with Zhou and Mou's (2022) research, which reports an increase in negative sentiment in China over the same period.

The prevalence of positive feelings was independent of the topics covered. It appeared linked to both professional development (self-learning, digital competence development and virtual classroom resources) and adverse situations (confinement, de-escalation, safe return to the classroom, concern about disease). This suggests that writing, reading and sharing tweets became a very important emotional support mechanism in teachers' networks.

These findings are consistent with other studies that indicate that teachers use Twitter as a space in which to experience emotional support from a professional learning community (Trust et al., 2018; Xing & Gao, 2018).

Although negative emotional content is the least frequent, the increase in the period of confinement of negative feelings related to the technological difficulties of online education and the political management of the educational consequences of Covid-19 is significant.

Although not an objective of our study, our results suggest that the historical Twitter archive is a valid resource for the analysis of teachers' sentiments in longitudinal research that includes the Covid-19 period, as demonstrated by Harron and Liu (2022).

Limitations

Among the limitations of this study, we can point out our sampling decision, which focuses on Spanish teachers. Future research can expand the sample to include teachers from different Spanish-speaking countries to allow a comparative study. Another limitation of the study is that a mainly quantitative approach based on public data mining and sentiment analysis was used to examine professional networks. Although qualitative content analysis was used to answer some research questions, it would be valuable to use other qualitative methods such as interviews or focus groups to obtain more detailed information about teachers' concerns and interests in social networks.

CONCLUSION

This study shows that Spanish teachers use social networks for professional development and emotional support and that this trend has increased during Covid-19. The use of Twitter increased during the confinement period and the state of alarm due to Covid. Our results show that teachers' motivations to use digital technologies in their teaching practice increased during the pandemic. Consequently, we can affirm that in emergency situations, Twitter facilitated the creation of flexible and effective professional networks of teachers, which were formed around educational hashtags. The notable increase in retweets as a form of content sharing during confinement reinforces the conclusion that strong and sustained networks were established to deal with the situation of uncertainty in the educational context. Specifically, teachers in Spain tweeted to request and share educational resources, and to address issues related to virtual teaching and health measures being implemented in the school environment.

In addition, the technological tools most used before and after Covid-19 by teachers in Spain have been identified, which favours the development of future informal learning initiatives in digital spaces. The main resources referred to on Twitter for managing e-learning were Genially, Wakelet, Flipgrid, Quiz, and Canva. These results are an indicator of the kind of information and resources teachers are looking for in a crisis like Covid-19, which is useful for action in similar scenarios.

Twitter was not only used as a professional network, but this study also shows that emotional support networks were built among teachers, characterised by positive emotional content, although negative emotional content related mainly to technological difficulties and political management of the pandemic also increased during confinement.

Our findings do not simply describe the issues that matter to teachers but highlight how the context implies change and how this influences continuing professional development. This information will enable us to provide comprehensive coverage for teachers, involving professional, emotional, and political support.

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Psychometric validation of the scale «Technological Pedagogical Knowledge of Content TPACK-ES» and assessment of self-efficacy perceived by prospective teachers

Validación psicométrica de la escala «Conocimiento Tecnológico Pedagógico del Contenido TPACK-ES» y evaluación de la autoeficacia percibida por el futuro profesorado

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ABSTRACT

Despite the usefulness of the analysis of the perception of self-efficacy in the success and performance of teachers and students in the teaching-learning process proposed by the TPACK (Technological Pedagogical Content Knowledge) model, there is little research focused on the beliefs and perceptions of future teachers. The present research has a double objective: on the one hand, it seeks to validate the psychometric properties of the TPACK-ES scale in the Spanish context; and on the other hand, to analyse the perceptions

of self-efficacy in the model of Primary and Secondary Education teachers in initial training. A total of 303 university students with a mean age of 23.12 ± 3.21 years, enrolled in a university in the north of Spain, agreed to participate in this study. The results obtained confirm the heptafactorial structure of the model, its internal consistency, structural stability and adaptation to optimal fit indices. Likewise, statistically significant differences are identified in the TK and TPK dimensions, in structuring variables of the model and in the PK (pedagogical knowledge), PCK (pedagogical knowledge of content), TPK (pedagogical technological knowledge) and TPACK dimensions, depending on the level of teacher training and the gender of the future teacher. These results indicate the need to continue to analyse the contextual factors of the TPACK model in order to ensure its suitability and true effectiveness in initial teacher training.

Keywords: TPACK, validation, digital gap, higher education, teacher training

RESUMEN

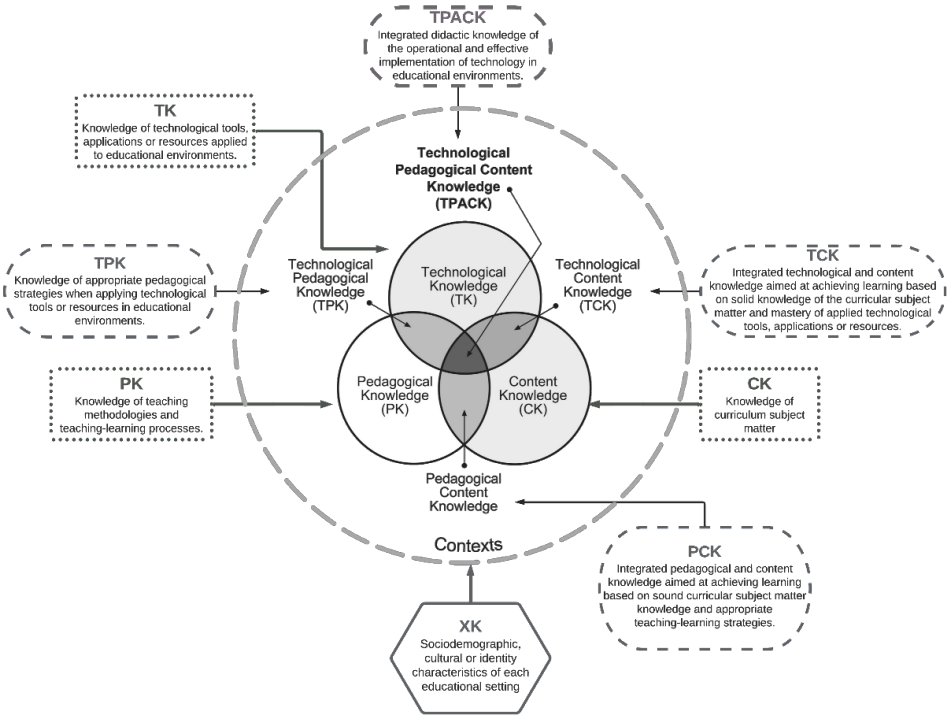
A pesar de las utilidades del análisis de la percepción de la autoeficacia en el éxito y rendimiento del profesorado y alumnado en el proceso de enseñanza-aprendizaje propuesto por el modelo TPACK (Conocimiento Tecnológico Pedagógico del Contenido), resultan escasas las investigaciones focalizadas en las creencias y percepciones del futuro profesorado. La presente investigación tiene un doble objetivo: por una parte, busca validar las propiedades psicométricas de la escala TPACK-ES en el contexto español; y por otra, analizar las percepciones de la autoeficacia en el modelo del profesorado de Educación Primaria y Educación Secundaria en formación inicial. Accedieron a participar en este estudio 303 estudiantes universitarios con una media de edad de 23.12 ± 3.21 años, matriculados en una universidad del norte de España. Los resultados obtenidos confirman la estructura heptafactorial del modelo, su consistencia interna, estabilidad estructural y adaptación a índices de ajuste óptimos. Igualmente, se identifican diferencias estadísticamente significativas en las dimensiones TK y TPK, en variables estructurantes del modelo y en las dimensiones PK (conocimiento pedagógico), PCK (conocimiento pedagógico del contenido), TPK (conocimiento tecnológico pedagógico) y TPACK, en función del nivel formativo-docente y del género del futuro profesorado. Estos resultados informan de la necesidad de continuar atendiendo al análisis de factores contextuales al modelo TPACK para su adecuación y verdadera efectividad en la formación inicial del profesorado.

Palabras clave: TPACK, validación, brecha digital, educación superior, formación de docentes

INTRODUCTION

The Technological Pedagogical Technological Content Knowledge (TPACK) model is one of the most recognised major theoretical-methodological frameworks for the assessment of teacher competence levels. The integrated combination of its dimensions includes the effective implementation of technology during the teaching process and the teaching-learning process, especially influential in the period of the COVID-19 health crisis (Manokore & Kuntz, 2022). As can be seen in Figure 1, this model provides a coherent integrated alignment of the basic levels of digital competence in teaching, guiding decision-making and promoting digital literacy.

Figure 1
TPACK Model



Note: Prepared by author based on Janssen et al. (2019).

Despite the abundant international scientific literature available on their potential in teacher professional development from different curricular disciplines, classroom practices (Anderson & Kyzar, 2022; Kartal & Çınar, 2022; Sun et al, 2022; Tan & Chen, 2022) and teaching-learning spaces (Assis & Vieira-Santos, 2021; Ortega-Sánchez & Gómez-Trigueros, 2020), there is still a need to evaluate their effects in the field of initial teacher education (Aktaş & Özmen, 2020; Ismaeel & Aktas, 2022; Widyasari et al., 2022). In this line, its usefulness and impact on the professional development of in-service teachers through the improvement of knowledge, self-efficacy, digital competence and skills for technology integration in the classroom has been demonstrated (Chen & Cao, 2022; Oda et al., 2020).

Studies aimed at analysing its impact on the operational and effective use of technology from the specific field of teacher training are recent (Schmidt-Crawford et al., 2021), inseparable from the other components of the TPACK model (Ortiz-Colón et al., 2020), and few studies consider its impact in terms of the level of teacher training of future teachers and active teachers (Castéra et al., 2020; Cheng & Xie, 2018). Despite the usefulness of the analysis of perceived self-efficacy in the success and performance of teachers and students in the quality of teaching-learning processes, there is little research focused on prospective teachers' beliefs and perceptions of their self-efficacy in the multidimensional framework of the TPACK model (Alpaslan et al., 2021; Diamah et al., 2022; Nazari et al., 2019; Tondeur et al., 2019; Wang et al., 2020), particularly in the social sciences (Ciriza-Mendívil et al., 2022). Similarly, "although [practising] teachers' beliefs about TPACK influence [the] incorporation of technology in the classroom, few studies analyse them" (Liu, 2022, p. 305). Indeed, "the use of TPACK-based training to promote trainee teachers' perceptions of TPACK remains limited" (Diamah et al., 2022, p. 3).

Technological inclusion, for pedagogical purposes, for the acquisition and development of digital competences from an integrated perspective has been one of the most significant teaching and research concerns in the field of education (Cabero & Martínez, 2019). In this sense, the TPACK model has been proposed as an appropriate framework for teacher professional development, based on the coherent interrelation between curricular content, didactics and technology in specific contexts. Part of its complexity lies in this last element. Indeed, the "context makes the TPACK model unique, located in a time and place, idiosyncratic, adaptive, specific and different for each teacher; hence the difficulty generated by its measurement" (Jiménez & Cabero, 2021, p. 7).

The benefits of TPACK need to be complemented by specifying the factors that influence its development (Huang et al., 2020). From this perspective, the gender effect is presented as one of its fundamental components (Castéra et al., 2020). According to Long et al. (2020), divergences according to this factor could be due

to "different attitudes of male and female teachers towards the use of technology and perceived self-confidence in teaching. Female teachers tend to have higher PK but lower TK than male teachers, while male teachers tend to have higher self-efficacy in using technology" (p. 5). Similarly, gender and level of teacher training in ICT were recorded as influential personal factors in Greek Primary School teachers' perceptions of their TPACK skills (Roussinos & Jimoyiannis, 2019). The same study pointed to the relevance of the educational context.

Considering its complexity, context has recently been proposed as an eighth domain (contextual knowledge, XK) about teachers' knowledge of technological resources and educational policies (Mishra, 2019). However, for this dimension we propose to consider the contextual factors derived from the socio-demographic, cultural or identity characteristics of the educational environments in which the TPACK model is developed. In this line, the present research has a twofold objective: on the one hand, it seeks to validate the psychometric properties of the TPACK-ES scale in the Spanish context; and on the other hand, to analyse the perceptions of self-efficacy in the model of Primary and Secondary Education teachers in initial training. In relation to this second objective, it formulates four hypotheses, based on the suggestion of Chai et al. (2016) on the examination of the effect of teacher gender on the domains of the TPACK model, the results of Roussinos and Jimoyiannis (2019) and Castéra et al. (2020), and the study of the educational level proposed by Ibrohim et al. (2022) and Long et al. (2020). We complete these hypotheses with the analysis of the potential interaction of both variables.

- $H_{1(1)}$ The dimensional values of the TPACK model are higher in male than in female future teachers.
- $H_{1(2)}$ The dimensional values of the TPACK model are higher in females than in males future teachers.
- $H_{1(3)}$ There are statistically significant differences in the values obtained in the self-perception of efficacy in the TPACK domains and the level of education of the prospective teacher.
- $H_{1(4)}$ There is an interaction between the factors gender and university studies in the perceived self-efficacy of future teachers on the dimensions of the TPACK model.

METHOD

Participants

Participants were selected by means of purposive or convenience sampling, in accordance with the research team's possibilities of access to the field of study and according to their degree of suitability to the objectives formulated. A total of 303 students of Primary and Compulsory Secondary Education (68% female and 32% male) with a mean age of 23.12 ± 3.21 years, enrolled in a university in the north of Spain, agreed to participate in the research. With a margin of error of 5% and a confidence level of 95%, the sample is considered significant with respect to the total population from which it is drawn (N = 1265) (Otzen & Manterola, 2017) (Table 1).

Table 1
Socio-demographic characteristics

Gender		Studies			
♂	♀	1	2	3	4
$f_i(p_i)$	$f_i(p_i)$	$f_i(p_i)$	$f_i(p_i)$	$f_i(p_i)$	$f_i(p_i)$
97(32)	206(68)	107(35.5)	93(30.7)	56(18.5)	47(15.5)

Note. 1 = First year of the Bachelor's Degree in Primary Education. 2 = Second year of the Degree in Primary Education. 3 = Third year of the Bachelor's Degree in Primary Education. 4 = Master's Degree in Secondary Education.

Instrument

Consistent with the TPACK model as the most widespread and frequent measurement method, both in terms of its effectiveness and cost-effectiveness, the self-report questionnaire was selected as the data collection instrument. In all cases, the development of the scales has evidenced the expected factor structure (Kadioglu-Akbulut et al., 2020; Schmidt-Crawford et al., 2020).

The applied instrument (TPACK-ES) consists of 32 items distributed in 7 dimensional blocks or TPACK domains [*TK-Technological* Knowledge (4 items), *CK-Content* Knowledge (4 items), *PK-Pedagogical* Knowledge (7 items), *PCK-Pedagogical Content Knowledge* (3 items), TCK-Technological Content Knowledge (3 items), TPACK-Technological Pedagogical Content Knowledge (9 items) and TPACK-Technological Pedagogical Content Knowledge (2 items), *TCK-Technological Content*

*Knowledge (*3 items), *TPK-Technological Pedagogical Content* Knowledge (9 items) and *TPACK-Technological Pedagogical Content* Knowledge (2 items)], measured on a five-point Likert-type scale, where 1 corresponded to *strongly disagree* and 5 to *strongly agree*.

The applied instrument was adapted according to the criteria developed by Schmidt-Crawford et al. (2009, 2020), so the theoretical dimensions of the TPACK were known. In order to determine the goodness of fit, structure and stability of the instrument for the data collection of this research, tests of validity, reliability and between-group invariance were conducted by applying the methods of Confirmatory Factor Analysis (CFA), Cronbach's alpha and McDonald's omega, and factorial invariance analysis, respectively, from the study population.

In order to generalise the results and the final CFA model, we estimated and diagnosed the model by analysing the total data, as the "recommendation to split the sample leads to a reduction of the initial sample size, which is not irrelevant considering that most studies use smaller sample sizes than those required by the general rule" (Fernández-Hernández et al., 2022, p. 39).

Internal consistency validity

The estimation of the internal consistency reliability of the items of the measuring instrument was calculated using Cronbach's alpha coefficient (α) and McDonald's omega method (ω); the justification for incorporating the latter method resided in its usefulness to "try to mitigate the inadequate use of Cronbach's alpha when its statistical assumptions are not met" (Frías-Navarro & Pascual-Soler, 2022, p. 5). Firstly, the reliability indicator was calculated for the entire scale and, secondly, for each of the proposed factors or constructs. The coefficients returned indicate their adequacy and proximity to those obtained in factor distributions that, from differential structural scales, are based on the TPACK theoretical model (Table 2).

Table 2

Internal consistency coefficients of instruments and/or instrumental adaptations based on the TPACK model

Scale	TK	CK	PK	PCK	TCK	TPK	TPACK
α	α	α	α	α	α	α	α
.98[a]	.81	.82	.76	.82	.88	.81	.79
.96[b]	.83-.94	.83-.94	.83-.94	.83-.94	.83-.94	.83-.94	.83-.94
.95[c]	.61	.78	.87	.81	-	.86	.92
.85[d]	-	-	-	-	-	-	-
-[e]	.88	.86	.97	.94	.84	.84	.93
-[f]	.86	.86	.86	.86	.84	.82	.83
.95[g]	-	-	-	-	-	-	-
-[h]	.90	.88	.95	.78	.83	.91	.89
-[i]	.82	≈.81	.84	.85	.80	.86	.92

ω	α	ω	α	ω	α	ω	α	ω	α	ω	α	ω	α	ω	α
.93	.93*	.80	.80	.77	.77	.84	.84	.80	.76	.78	.76	.83	.82	.61	.61

Note.[a] = Fernández-Chávez et al. (2022);[b] = Joldanova et al. (2022);[c] = Diamah et al. (2022);[d] = Widyasari et al. (2022);[e] = Ibrohim et al. (2022);[f] = Jiménez and Cabero (2021);[g] = Ortiz-Colón et al. (2020);[h] = Cabero (2014);[i] = Schmidt-Crawford et al. (2009); * Ortega-Sánchez (2023).

Construct validity

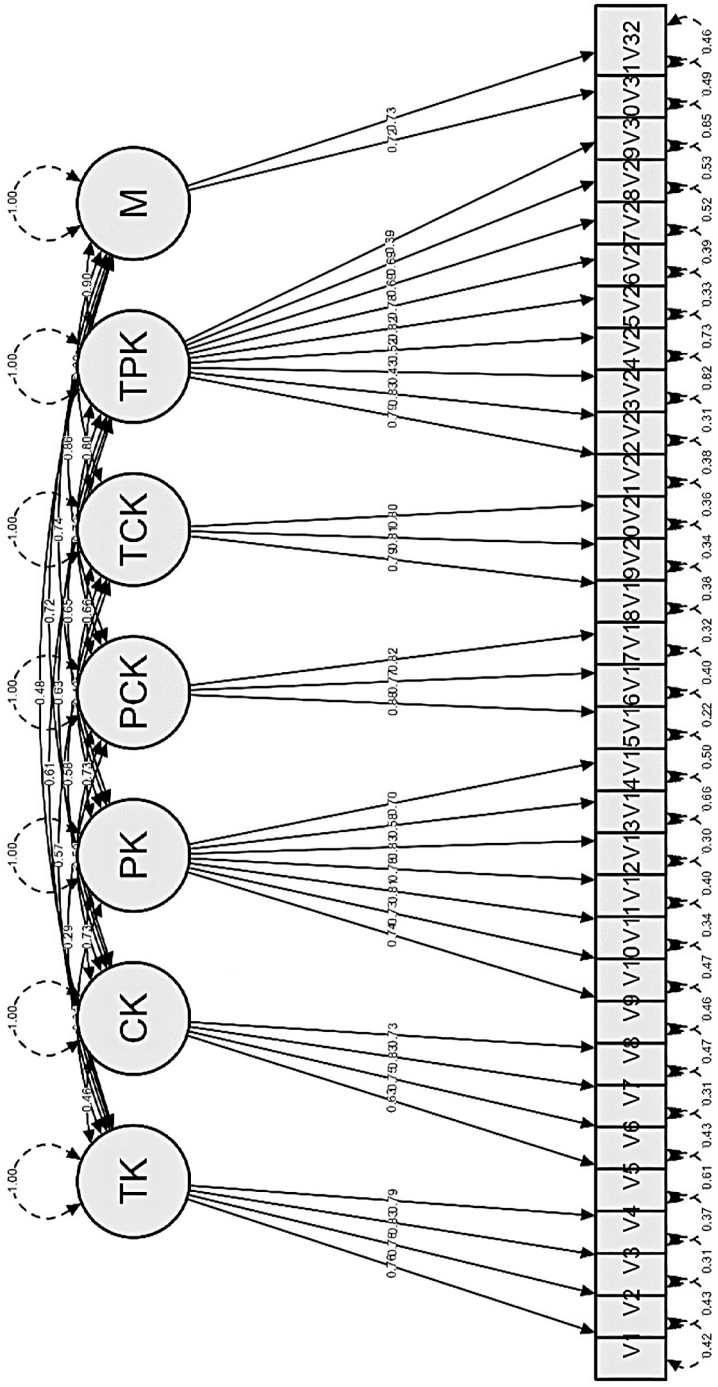
In order to verify and accept the questionnaire and its factorial structure, the necessary analyses were carried out to assess its instrumental usefulness in the measurement of the competences associated with the TPACK model. Thus, based on the scientific literature and applied instruments related to self-efficacy in the theoretical and procedural dimensions of the model, we tested 7 hypotheses on latent variables (constructs), defined on the basis of 32 observed variables or indicators. Previous Exploratory Factor Analysis (EFA) guided the numerical and factorial distribution and the choice of the number of indicators for each latent variable.

Our purpose was to identify the relationship between these indicators and their constructs (factors), and between the constructs themselves, based on the resulting measures of goodness of fit. To this end, and within the framework of structural

equation analysis using covariance structures, we conducted a Confirmatory Factor Analysis (CFA). The estimation method employed, consistent with the sample size, was maximum likelihood estimation, for which a sample size of around 200 observations is recommended (Bentler, 1989).

Hu and Bentler (1999) recommended that the model be fitted by paying attention to the RMSEA (Root Mean Square Error of Approximation) and SRMR (Standardised Root Mean Square Residual) indices, whose recommended values are < .08, and the CFI (Comparative Fit Index), whose optimal values are > .95 (Jöreskog & Sörbom, 1993; Schumacker & Lomax, 2015) (Figure 2) (Figure 2).

Figure 2
Confirmatory factor analysis. Path diagram of the final model



Note: M = TPACK integrated dimensional model.

Both the parsimony fit measure ($\chi^2_{(443)}$ 868, $p < .001$, χ^2 /df = 1.95 [< 5]) and the overall absolute and comparative fits achieved can be considered satisfactory (Table 3).

Table 3
Absolute fit (RMSEA and SRMR) and comparative fit (CFI and TLI)

				RMSEA 90% CI	
CFI	TLI	SRMR	RMSEA	Lower	Upper
0.987	0.985	0.065	0.058	0.052	0.064

Discriminant validity

Empirical evidence of the existence of discriminant validity was obtained by applying the confidence interval test of the correlations (Anderson & Gerbing, 1988) between the seven factors that make up the theoretical model of Mishra and Koehler (2008). According to the correlation matrix ($p < .001$) and the confidence intervals obtained (Table 4) and, considering that none of them contains 1 at 95% confidence, the discriminant validity of the scale can be confirmed (Henseler et al., 2015).

Convergent validity

Finally, the convergent validity of each latent construct is analysed on the basis of the Average Variance Extracted (AVE) (Lévi & Varela, 2006). The coefficients returned show that the heptafactorial structure of the model presents sufficient evidence of convergent validity (TK [4 items]: AVE = 0.689; CK [4 items]: AVE = 0.648; PK [7 items]: AVE = 0.648; PCK [3 items]: AVE = 0.633; TCK [3 items]: AVE = 0.371; TPK [9 items]: AVE = 0.614); TPACK [2 items]: AVE = 0.547). It can be stated that more than 50% of the variance of each construct is due to its indicators and, therefore, its suitability for the empirical explanation of the latent constructs can be concluded.

Table 4

TPACK model factor correlations and confidence intervals

R		TK	CK	PK	PCK	TCK	TPK	TPACK
TK	*r*	—						
	P	—						
	Upper 95% CI	—						
	Lower 95% CI	—						
CK	*r*	.353	—					
	P	< .001	—					
	Upper 95% CI	0.447	—					
	Lower 95% CI	0.250	—					
PK	*r*	.253	.597	—				
	P	< .001	< .001	—				
	Upper 95% CI	0.356	0.665	—				
	Lower 95% CI	0.144	0.519	—				
PCK	*r*	.216	.451	.592	—			
	P	< .001	< .001	< .001	—			
	Upper 95% CI	0.321	0.537	0.661	—			
	Lower 95% CI	0.105	0.356	0.514	—			
TCK	*r*	.432	.439	.404	.545	—		
	P	< .001	< .001	< .001	< .001	—		
	Upper 95% CI	0.520	0.526	0.494	0.620	—		
	Lower 95% CI	0.335	0.343	0.305	0.460	—		
TPK	*r*	.492	.495	.546	.564	.645	—	
	P	< .001	< .001	< .001	< .001	< .001	—	
	Upper 95% CI	0.573	0.576	0.620	0.636	0.706	—	
	Lower 95% CI	0.402	0.405	0.462	0.482	0.573	—	
TPACK	*r*	.329	.479	.521	.611	.630	.676	—
	P	< .001	< .001	< .001	< .001	< .001	< .001	—
	Upper 95% CI	0.426	0.561	0.599	0.678	0.694	0.733	—
	Lower 95% CI	0.225	0.387	0.434	0.535	0.556	0.609	—

Note. *R*. Factorial relationship.

Factor invariance analysis

Considering the lack of studies in Spanish teacher training contexts that have evaluated the stability of the structure of the measurement instruments based on the TPACK model among different subgroups, we analyse the factorial invariance of the TPACK-ES scale. With this analysis, we hope to verify the independence of its measurement properties from the characteristics of the groups being compared, to obtain empirical evidence of its stability, to check the absence of bias in the measurement and, therefore, to guarantee the validity of the results.

In order to find out what extent measurement invariance existed, we performed a multi-group structural equation modelling (SEM), based on the grouping variables gender and educational level. In this modelling, we included the mean structure for the three proposed models: Model 1 (configurational invariance), Model 2 (metric invariance) and Model 3 (scalar or strong invariance) (Rens van de Schoot & Hox, 2012).

The results returned (Table 5 and Table 6) indicate that the factor model can be applied to all comparison groups and that the factor loadings are equal across groups ($p > .05$). This circumstance makes possible the statistical comparison of structural relationships between latent variables between groups. It is also evident that the intercepts of the items are equal in the groups of interest ($p > .05$), which proves the usability of the scale for intergroup comparison of means. Given that the factor structure, factor loadings and intercepts can be considered invariant, the instrument meets the equivalence criteria (Abalo et al., 2006).

Table 5
Model fits. Grouping variable: gender

				Reference contrast			Contrast of differences		
	AIC	BIC	*n*	χ^2	gl	*p*	$\Delta\chi^2$	Δgl	*p*
Model 1	19780.409	20649.423	303	1547.724	886	< .001			
Model 2	19871.729	20555.056	303	1739.044	936	< .001	191.320	50	.382
Model 3	19868.885	20433.372	303	1800.200	968	< .001	61.156	32	.269

Table 6
Model fits. Grouping variable: educational level

				Reference contrast			Contrast of differences		
	AIC	BIC	*n*	χ^2	gl	*p*	$\Delta\chi^2$	Δgl	*p*
Model 1	19545.691	21283.718	303	2984.251	1772	< .001			
Model 2	19626.079	20992.733	303	3264.639	1872	< .001	280.388	100	.458
Model 3	19684.297	20694.433	303	3514.857	1968	< .001	250.218	96	.327

Design and procedure

The present research belongs to the non-experimental cross-sectional studies (Ato et al., 2013). The instrument was administered to the participant sample in a single 30-minute session during the second semester of the 2021-2022 academic year, with prior communication of the purpose of the study and the confidentiality with which the data would be treated. Likewise, their consent was requested to use the responses obtained.

The study was conducted in accordance with the guidelines of the Declaration of Helsinki (Declaration of the World Medical Association), guaranteeing the ethical-philosophical commitment and unwavering respect for human dignity, privacy, physical and moral integrity, as well as the protection of personal data in the processing o f the survey and throughout the research. Privacy regulations were complied with, taking into account the personal data protection code (Organic Law 3/2018), anonymity and informed consent. The study was also reviewed and approved by the Bioethics Committee of the university responsible for the research (IR 15/2018).

Data analysis

After applying the Kolmogorov-Smirnov hypothesis test and testing the absence of the expected normality in the variables and factors that make up the construct, their skewness and kurtosis values were calculated. Since the skewness results for each variable were below 2 (*S* = 0.260 - 1.898, *SE* = 0.140 - 0.141) and the kurtosis results were below 7 (*K* = 0.020 - 2.433, *SE* = 0.279 - 0.281), it can be considered that the distribution is close to normal (Curran et al., 1996). Likewise, for the fulfilment of this assumption in the application of parametric statistics, this tendency to normality was identified in each study variable and comparison group (*gender*) (*S* = -0.984 _ -1.456, *SE* = 0.169 - 0.245; *K* = 0.942 - 1.012, *SE* = 0.377 - 0.485), and in each

scale factor and comparison group (*gender*) (*S* = -0.725-0.230, *SE* = 0.169 - 0.246; *K* = 0.634 - 1.003, *SE* = 0.377 - 0.488). Having identified the absence of equality of variances (homoscedasticity) in 6 of the 32 items of the scale and in its fifth factor (TCK), the Welch's test, Student's t-test for independent samples, was applied.

Once the assumption of homoscedasticity and descriptive normality (skewness and kurtosis) (*S* = -0.23 __ -0.712, *SE* = 0.140; *K* = 0.159 - 0.918, *SE* = 0.279 - 0.280) in the group distributions of the *study* variable was verified, we sought to test the existence of statistically significant differences according to this variable, identify the predictor variables and evaluate the joint effect or interaction of the categorical variables *gender* and *level of study* on the TPACK dimensional model. For this purpose, single-factor ANOVAs, 2x4 factorial ANOVAs and Bonferroni *post-hoc* analyses were carried out to determine the specific differential levels and their potential effects. Finally, the analyses are completed with effect sizes and the calculation of statistical power.

Checking for the absence of multivariate *outliers* was done by calculating the Mahalanobis distance. The results returned report *p-values* greater than .001 (*p* = .21 - .90) for all scale factors. Consequently, given the absence of missing cases and/or outliers, the application of value imputation techniques was not necessary. Furthermore, in order to identify possible neglected responses, we proceeded to study the individual reliability of the items (Huang & Wang, 2021) using the *Partial Least Squares* Analysis Method (PLS-SEM). The results obtained show that the items that make up the scale are reliable, as the loadings of their coefficients have values above 0.7 (0.832 - 0.912). Therefore, the presence of random responses, inattentive or with a possible insufficient effort to respond (IER [*Insufficient Effort Responding*] or CR [*Careless Responding*] is not identified, a circumstance that has motivated the non-application of bias controls.

For data processing, the statistical packages SPSS v.25, JASP 0.16.4.0, G*Power v.3.1.9.7. and SmartPLS v. 3.3 were used.

RESULTS

The group results report statistically higher mean levels in men in variables related to the TK [*Technological Knowledge*] dimension (ability to solve technical problems with technologies, ability to learn technology and update new technologies), CK [*Content Knowledge*] (sufficiency in content knowledge), PK [*Pedagogical Knowledge*] (familiarity with common misconceptions in students), TCK [*Technological Content Knowledge*] (technological training for teaching) and, fundamentally, with the TPK [*Technological Pedagogical Knowledge*] dimension (selection of technologies for learning, selection of technological resources for teaching, selection of technologies for teaching and learning, leadership in teaching

support for the use of technologies and diverse methodologies, and representation of the usefulness of technologies in the teaching task). When the hypothesis reverses its premises (Group 1 [Men] < Group 2 [Women]), however, no statistically significant increases in value are evident in any variable or factor.

Consequently, a higher self-perceived male dominance of technological knowledge and competence (M♂ = 3.83-4.03, *SD* = 0.71-0.95; M♀ = 3.51-3.74, *SD* = 0.84-0.93), and of knowledge about teaching and learning processes with technology (M♂ = 3.77-4.37, *SD* = 0.68-0.93; M♀ = 3.50-4.18, *SD* = 0.66-0.83) can be identified. However, these results record small to moderate effect sizes (*d* = 0.214-0.457) and low statistical power validity indices (1-β = .459-.723). The mean values are close to 4, confirming an optimal degree of identification with the formulated competence statements. These levels find dimensional correspondence, consistently, with the TK factor (M♂ = 3.99, *SD* = 0.65; M♀ = 3.70, *SD* = 0.67, *d* = 0.439, 1-β = .673) and the TPK factor (M♂ = 3.96, *SD* = 0.52; M♀ = 3.83, *SD* = 0.48, *d* = 0.259, 1-β = .492) (Table 7) (Table 7).

Table 7

Comparison of values by variables and factors according to gender (male > female)

	♂ (*n* = 97)	♀ (*n* = 206)	*t*	df	*p*	1-β	*d*
	M (SD)	M (SD)					
TK (V1)*	4.03 (0.78)	3.64 (0.87)	3.808	208.922	< .001	.723	0.457
TK (V2)*	4.03 (0.71)	3.74 (0.84)	3.099	219.766	.001	.459	0.370
TK (V3)	3.83 (0.95)	3.51 (0.93)	2.806	301	.003	.527	0.349
F1_TK	3.99 (0.65)	3.70 (0.67)	3.473	301	< .001	.673	0.439
CK (V5)	3.81 (0.83)	3.60 (0.83)	1.991	300	.024	.489	0.240
PK (V14)	3.66 (0.82)	3.41 (0.80)	2.415	301	.008	.494	0.296
TCK (V19)*	3.85 (0.96)	3.66 (0.78)	1.696	156.405	.046	.529	0.217
TPK (V22)	3.89 (0.68)	3.73 (0.75)	1.839	299	.033	.528	0.235
TPK (V23)	4.04 (0.70)	3.86 (0.66)	2.127	300	.017	.501	0.262
TPK (V27)	3.95 (0.78)	3.80 (0.69)	1.734	298	.042	.505	0.214
TPK (V29)	3.77 (0.93)	3.50 (0.83)	2.548	299	.006	.480	0.304
TPK (V30)	4.37 (0.76)	4.18 (0.75)	1.964	298	.025	.481	0.236

	♂ (*n* = 97)	♀ (*n* = 206)	*t*	df	*p*	1-β	*d*
	M (SD)	M (SD)					
F6_TPK	3.96 (0.52)	3.83 (0.48)	2.140	301	.017	.492	0.259

Note. The one-tailed alternative hypothesis specifies that the male group is larger than the female group. *Welch's test.

There are no significant factorial interactions between gender and education in any of the domains of the TPAK model [TK ($F_{(3, 295)}$ = .602, p = .614), CK ($F_{(3, 295)}$ = .602, p = .227), PK ($F_{(3, 295)}$ = .786, p = .503), PCK ($F_{(3, 293)}$ = .773, p = .510), TCK ($F_{(3, 293)}$ = 1.179, p = .318), TPK ($F_{(3, 295)}$ = .334, p = .801) and TPACK ($F_{(3, 293)}$ = .457, p = .712).

Although no statistically significant differences are identified as a function of educational background in the TK and CK dimensions ($F_{(3, 295)}$ = .745, p = .526; $F_{(3, 295)}$ = 1.462, p = .225), the remaining factors report their existence with moderate effect sizes (f = 0.263-0.351), except for the TPK domain with a small effect size (f = 0.175). Considering the values returned by statistical power (*1*-β = .762-.985) [greater than .80], the differences identified can be generalised to the population from which the data are drawn, except for the TPK domain with reduced statistical power (*1*-β = .617) (Table 8).

Table 8

Comparison of factor values as a function of educational level

	♂ (*n* = 97)	♀ (*n* = 206)	*F*	df	*p*	1-β	*f*
	M (SD)	M (SD)					
PK[a]	3.93 (0.55)	3.78 (0.62)	10.039	3	< .001**[a]	.853	0.282
PK[b]	4.13 (0.46)	3.90 (0.46)					
PK[c]	3.85 (0.40)	3.80 (0.41)					
PK[d]	3.45 (0.62)	3.50 (0.54)					
PCK[a]	3.81 (0.52)	3.61 (0.67)	13.070	3	<.001**[b] / *[a]	.985	0.351
PCK[b]	3.65 (0.78)	3.75 (0.52)					
PCK[c]	3.45 (0.60)	3.34 (0.65)					
PCK[d]	3.04 (0.86)	3.05 (0.74)					
TCK[a]	3.87 (0.87)	3.47 (0.73)	7.870	3	< .001**[c] / *[b]	.762	0.263
TCK[b]	3.45 (0.79)	3.50 (0.61)					
TCK[c]	3.21 (0.88)	3.05 (0.75)					
TCK[d]	3.23 (0.80)	3.08 (0.71)					

	♂ (*n* = 97)	♀ (*n* = 206)	*F*	df	*p*	1-β	*f*
	M (SD)	M (SD)					
TPK[a]	4.08 (0.56)	3.88 (0.45)	4.077	3	.024*[c]	.617	0.175
TPK[b]	4.03 (0.53)	3.88 (0.47)					
TPK[c]	3.80 (0.46)	3.76 (0.52)					
TPK[d]	3.82 (0.43)	3.62 (0.48)					
TPACK[a]	3.82 (0.73)	3.79 (0.68)	10.858	3	< .001**[d]/ *[d]	.947	0.318
TPACK[b]	3.84 (0.85)	3.80 (0.66)					
TPACK[c]	3.38 (0.62)	3.53 (0.65)					
TPACK[d]	3.28 (0.68)	3.10 (0.72)					

[a] = second year of Bachelor's degree;[b] = third year of Bachelor's degree;[c] = fourth year of Bachelor's degree;[d] = Master's degree.

** p^a < 0.01 between second year Bachelor and Master (*M* = 3.83-3.48, *SD* = 0.60-0.58), third year Bachelor and Master (*M* = 3.96-3.48, *SD* = 0.47-0.58), and fourth year Bachelor and Master (*M* = 3.81-3.48, *SD* = 0.41-0.58).

[a] p*< 0.05 between the second and fourth year of the Bachelor's degree (*M* = 3.67-3.37, *SD* = 0.64-0.63). ** p^b < 0.01 between third and fourth year undergraduate (*M* = 3.72-3.37, *SD* = 0.59-0.63), second year undergraduate and Master's (*M* = 3.67-3.04, *SD* = 0.64-0.79), and third year undergraduate and Master's (*M* = 3.72-3.04, *SD* = 0.59-0.79).

[c] p**< 0.01 between the second and fourth year of the Bachelor's degree (*M* = 3.59-3.10, *SD* = 0.79-0.79), and between the second year of the Bachelor's degree and the Master's degree (*M* = 3.59-3.15, *SD* = 0.79-0.77). * p^b < 0.05 between the third and fourth year of the Bachelor's degree (*M* = 3.49-3.10, *SD* = 0.66-0.79).

* p^c < 0.05 between second and fourth year undergraduate (*M* = 3.94-3.77, *SD* = 0.49-0.50), second year undergraduate and Master (*M* = 3.94-3.72, *SD* = 0.49-0.46), and third year undergraduate and Master (*M* = 3.92-3.72, *SD* = 0.49-0.46).

[d] p*< 0.05 between the second and fourth year of Bachelor's degree (*M* = 3.80-3.49, *SD* = 0.69-0.64), and the third and fourth year of Bachelor's degree (*M* = 3.81-3.49, *SD* = 0.71-0.64). ** p^d < 0.01 between the second year of Bachelor and Master (*M* = 3.80-3.19, *SD* = 0.69-0.70), and the third year of Bachelor and Master (*M* = 3.81-3.19, *SD* = 0.71-0.70).

DISCUSSION AND CONCLUSIONS

The results of the validity, reliability and stability of the TPACK-ES scale were satisfactory, a circumstance that will allow its application in other Spanish teacher training contexts with similar characteristics. According to the results obtained, statistically significant differences are identified according to the gender of the future teachers, in the domains related to technological experimentation (TK), in the understanding of how teaching-learning can improve when certain technologies are used (TPK), and in other structuring variables of the TPACK model. These results are consistent with those obtained by Ortiz-Colón et al. (2020) for the first dimension (TK) in in-service primary school teachers in Andalusia (Spain) (n = 607), with those returned by Koh et al. (2010) in trainee teachers in both dimensions and with those obtained by Cetin-Berber and Erdem (2015) in the first dimension, and distinctive with respect to those provided by Leal and Rojas (2020) for Colombian trainee teachers (n = 274), which conclude the absence of significant differences according to the gender declared by the participants.

They are also consistent with Ibrohim et al.'s study (2022) of Indonesian science teachers' perceptions of the TPACK model (n = 1,357). Their research identified significant differences according to the gender and educational level of the participants. Concurrent with the results of the present study, higher overall levels of men's TPACK competence perception were observed. These same results are in line with the findings of the meta-analysis by Yanpar Yelken et al. (2019) and the study by Beri and Sharma (2019), which identified significant differences between the types of knowledge of the TPACK model as a function of gender. In the context of these differences, in the present research, technological knowledge (TK) and technological pedagogical knowledge (TPK) have small to moderate (TK) effect sizes that are larger in favour of males.

As for content knowledge, technological content knowledge and pedagogical knowledge, where differences are identified in some of their variables (CK-V5, TCK-V19 and PK-V14), the analysis of Yanpar Yelken et al. (2019) observes full factorial differences; however, partially concurrently with the present research, small effect sizes in favour of men are recorded in all three domains. In line with the research of Gebhardt et al. (2019) and in the context of this research, it can be stated that men express a higher level of digital competence confidence and thus in the use of ICT and its application in learning than women. This digital gender gap seems to contrast with other recent studies in the field of teacher education (Pozas & Letzel, 2021).

In relation to the influence of educational level on perceptions of TPACK self-efficacy, significant differences are found in 5 (PK, PCK, TCK, TPK and TPACK) of the 7 dimensions of the model, with mean scores close to 4 in favour of men

in practically all the educational stages. However, no increase in these scores is identified as a function of the future teacher's educational progress. These results are consistent with those of Lee and Lee (2020) and Ibrohim et al. (2022), who identified the influence of educational level on in-service teachers' perception of TPACK; however, they differ in their descriptive trends, as higher scores were observed in teachers with a Master's degree in all domains. The results are in line with the findings of Long et al. (2020), who found significant differences according to the educational level of Chinese primary school teachers (*n* = 159), except for the TK and TPK dimensions, where males had higher scores than females. Similarly, these levels of perceived self-efficacy of prospective teachers contrast with those obtained in other geographical areas, as evidenced by the research results of Al-Abdullatif (2019) for Saudi teacher trainees and Wang et al. (2020) for Chinese prospective teachers.

Contextual factors such as learning styles, cultural, socio-economic (Ali & Hawk, 2022) and identity characteristics, or the influence of teachers' emotions (Huang et al., 2022) need to be considered in the articulation and design of teaching-learning activities based on the TPACK model. Consequently, it is necessary to diagnose and fill in the gaps in the development and innovation of this model in order to ensure its effective implementation. In this regard, we agree with Napitupulu and Sebayang (2022) in identifying the limitations in moving towards heutagogical and cyber-agogical learning designs related to TPACK-based learning, conditioned, among other factors, by the lack of access to studies on the impact of the model on learning and sufficient infrastructure support for its proper development.

The results show the influence of contextual factors on the processes of technology integration and on the assessment of perceived self-efficacy in digital competences by prospective teachers. Context, which includes factors linked to personal identity (gender) and prior education (Morgan et al., 2022), is indeed a complex and interrelated multi-layered structure. In this sense, the TPACK model is not reduced to a set of integrated knowledge and competences, but is also context-oriented, which in turn impacts on the aims of the model itself (Kulaksız & Karaca, 2022). Thus, the existence of a gender digital divide continues to be identified and, consequently, the need for more specific training in digital competence for teachers (Gisbert-Cervera et al., 2022), which considers the incorporation of contextual components in the design, implementation and evaluation of the TPACK model in teacher education.

Limitations

Despite the type of sampling, design (case study) and, therefore, the limited sample size, the results of the present research may be useful for the implementation

of teacher training programmes on the operational and effective implementation of the TPACK model. In addition, the drawbacks of administering the instrument as a self-report should be considered, especially in relation to the potential biases produced by social desirability and assent (De las Cuevas & González de Rivera, 1992). In this line, future work should triangulate the results obtained in this research with the application of techniques such as *on-site* observation, semi-structured and in-depth interviews, and the focus group, in order to understand the conceptions, teaching actions and didactic positions of trainee teachers on the integration of educational technology in their teacher training plans.

Finally, the cross-sectional design of this research suggests the need for further longitudinal studies (Lachner et al., 2021) capable of analysing, through different temporal measures, possible changes in the perception of future teachers' competence self-efficacy after the design, implementation and evaluation of specific teacher training programmes based on the TPACK model.

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APPENDIX

TK (Technological Knowledge)

1. I know how to solve my own technical problems with technologies.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agreed.
- ☐ I fully agree

2. I am able to learn to use any programme or technological tool easily.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agreed.
- ☐ I fully agree

3. I keep up to date with new technologies.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agreed.
- ☐ I fully agree

4. I have the technical skills I need to use technology in different contexts (personal, educational, administrative, etc.).

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agreed.
- ☐ I fully agree

CK (Content Knowledge)

5. I have sufficient knowledge of the content I am going to teach in my future work as a teacher.

   - ☐ Strongly disagree
   - ☐ Disagree
   - ☐ Neither agree nor disagree
   - ☐ Agreed.
   - ☐ I fully agree

6. I consider that I have sufficient resources to search for, process, organise and understand the disciplinary content that I will teach in my future work as a teacher.

   - ☐ Strongly disagree
   - ☐ Disagree
   - ☐ Neither agree nor disagree
   - ☐ Agreed.
   - ☐ I fully agree

7. I have a variety of methods and strategies to improve my understanding of the content of the subjects I have to teach in my future work as a teacher.

   - ☐ Strongly disagree
   - ☐ Disagree
   - ☐ Neither agree nor disagree
   - ☐ Agreed.
   - ☐ I fully agree

8. I am able to reflect on the curriculum for the level of education I will be teaching as well as any other experienced colleague.

   - ☐ Strongly disagree
   - ☐ Disagree
   - ☐ Neither agree nor disagree
   - ☐ Agreed.
   - ☐ I fully agree

PK (Pedagogical Knowledge)

9. I know how to assess student learning in a classroom.

- □ Strongly disagree
- □ Disagree
- □ Neither agree nor disagree
- □ Agreed.
- □ I fully agree

10. I can adapt my teaching according to the needs of the learners in order to make them understand the content I want to teach them.

- □ Strongly disagree
- □ Disagree
- □ Neither agree nor disagree
- □ Agreed.
- □ I fully agree

11. I consider that I am able to adapt my teaching methodology to the diversity of a classroom.

- □ Strongly disagree
- □ Disagree
- □ Neither agree nor disagree
- □ Agreed.
- □ I fully agree

12. I am able to carry out an assessment of classroom learning in multiple ways.

- □ Strongly disagree
- □ Disagree
- □ Neither agree nor disagree
- □ Agreed.
- □ I fully agree

13. I am able to use a wide range of teaching methodologies and strategies in a classroom.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

14. I am familiar with the common misconceptions of learners.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

15. I know how to organise and maintain classroom management.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

PCK (Pedagogical Content Knowledge)

16. I am able to select effective teaching methodologies and strategies to guide student learning in the content areas I will teach as a future teacher.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

17. The training I have received has enabled me to help students to solve real-world problems related to the contents I will teach as a future teacher.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agreed.
- ☐ I fully agree

18. The training I have received has enabled me to select appropriate assessment tools to assess students' learning performance.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agreed.
- ☐ I fully agree

TCK (Technology Content Knowledge)

19. I am trained in those technologies that I can use in the classroom to make understandable those contents and procedures that I will teach to my future students.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agreed.
- ☐ I fully agree

20. The training received has enabled me to use specific software tools for teaching.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agreed.
- ☐ I fully agree

21. The training I have received and the courses I have participated in have taught me which technologies I can apply to the teaching of disciplinary content.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

TPK (Technological Pedagogical Knowledge)

22. I can choose technologies that enhance the focus and understanding of a lesson or content for learners.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

23. I am able to select those technological resources that will facilitate my task as a teacher to work on a specific topic or content in the classroom.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

24. My training as a teacher has led me to think more deeply about how technology can influence the processes and teaching methodologies I will use in my future classes.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

25. I reflect critically on how to use technology in my future work as a teacher.

- □ Strongly disagree
- □ Disagree
- □ Neither agree nor disagree
- □ Agreed.
- □ I fully agree

26. I am able to adapt the use of the technologies I am learning in my teacher training to different teaching activities.

- □ Strongly disagree
- □ Disagree
- □ Neither agree nor disagree
- □ Agreed.
- □ I fully agree

27. I am able to select technologies to use in my future work as a teacher, which improve learning and the way content is transmitted and taught to students.

- □ Strongly disagree
- □ Disagree
- □ Neither agree nor disagree
- □ Agreed.
- □ I fully agree

28. I am able to use classroom strategies that combine different content, technologies and methodologies, which I have learnt in my teacher training.

- □ Strongly disagree
- □ Disagree
- □ Neither agree nor disagree
- □ Agreed.
- □ I fully agree

29. I can provide leadership to help other colleagues coordinate good use of technologies combined with diverse classroom methodologies.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

30. I consider that technologies help teachers in their regular task in the classroom to teach contents and procedures.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

TPACK (Technological Pedagogy and Content Knowledge)

31. I am able to prepare teaching materials that appropriately combine content, technologies and diverse classroom methodologies or strategies.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

32. The training I have received has enabled me to correctly combine the contents, technologies and methodologies to achieve the knowledge of a specific subject.

    □ Strongly disagree
    □ Disagree
    □ Neither agree nor disagree
    □ Agreed.
    □ I fully agree

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Family sociodemographic factors and cybervictimization in Primary Education

Factores sociodemográficos familiares y cibervictimización en Educación Primaria

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ABSTRACT

Cybervictimization is a social phenomenon in which a victim receives an intentional and aggressive act of harm from an aggressor/s, through technologies, from which victims cannot easily defend themselves. Victims present physical health symptoms, as well as low levels of psychological well-being and even higher levels of suicidal ideation and attempts. The alarming prevalence of cybervictimization in Primary Education in Spain ranges from 6.6% to 13.4% and has increased due to the COVID-19 confinement. For all these reasons, it is crucial to investigate the risk and protection factors that allow us to prevent them, especially those less studied in this educational stage, such as family sociodemographic variables. The objective of the study is to analyse the relationship between parental sociodemographic factors (age, gender, educational level, immigrant background, family composition, and degree of rurality of the municipality of family residence) and cybervictimization of their children in Primary Education. A sample of 1169 families with children in grades of 5th and 6th of Primary Education was selected, using a self-administered questionnaire (α = .84). Association studies were performed using binary logistic regression. The multivariate model followed a stepwise procedure, with the stepAIC function, selecting the best predictive

model. The bivariate analysis identified the parental educational level as an individual risk factor for cybervictimization ($p < .05$). In addition, single-parent families reached almost double the risk of two-parent families. The results of the multivariate analysis showed that gender, parental educational level, and family composition are jointly significant predictors of cybervictimization in Primary Education. It is concluded that there are family sociodemographic factors that predict cybervictimization and the results are analyzed for their implications for educational practice.

Keywords: bullying, cyberbullying, school violence, family, multivariate logistic, regression analysis

RESUMEN

La cibervictimización es un fenómeno social en el que una víctima recibe un acto intencional y agresivo de daño de un agresor/es, a través de las tecnologías, del que no puede defenderse fácilmente. Las víctimas presentan síntomas de salud física, así como bajos niveles de bienestar psicológico e, incluso, niveles más elevados de intentos e ideaciones suicidas. La prevalencia de la cibervictimización en Educación Primaria en España es alarmante, puesto que se sitúa entre el 6.6% y el 13.4%, incrementándose a raíz del confinamiento derivado del COVID-19. Por todo ello, resulta crucial investigar los factores de riesgo y de protección que nos permitan su prevención, especialmente sobre aquellos menos estudiados en esta etapa educativa como son las variables sociodemográficas. El objetivo del estudio es analizar la relación entre factores sociodemográficos parentales (edad, género y nivel educativo, antecedentes de inmigración, estructura familiar y grado de ruralidad del municipio de residencia familiar) y la cibervictimización en Educación Primaria de sus hijos. Se seleccionó una muestra de 1169 familias con hijos en 5º y 6º de Educación Primaria, valiéndose de un cuestionario autoadministrado ($\alpha = .84$). Los estudios de asociación se realizaron mediante regresión logística binaria. El modelo multivariante siguió un procedimiento *stepwise,* con la función *stepAIC,* seleccionándose el mejor modelo predictivo. Los análisis bivariantes identificaron el nivel educativo de la familia como factor de riesgo individual de la cibervictimización ($p < .05$). Además, las familias monoparentales alcanzaron casi el doble más de riesgo que las biparentales. Los resultados del análisis multivariante evidenciaron que el género, el nivel educativo y la estructura familiar se asocian significativamente de forma conjunta con la cibervictimización en Educación Primaria. Se concluye que existen factores sociodemográficos familiares que predicen la cibervictimización y se analizan las implicaciones que estos resultados suponen para la práctica educativa.

Palabras clave: acoso escolar, ciberacoso, violencia escolar, familia, logística multivariante, análisis de regresión

INTRODUCTION

The widespread use of technologies by children led to the expansion of bullying into the virtual space. The evolving technology and complexity of the phenomenon, combined with the use of multiple terms in different languages, make it challenging to clearly define cyberbullying. Within the framework of the definition of cyberbullying proposed by Smith et al. (2008), victimization refers to the experience of a student as a victim of an aggressive and intentional act of harm, by another person/s through technologies, which produces an imbalance of power between the victim and the aggressor/s, since they cannot easily defend themselves. However, the debate on the most appropriate definition is still open and there is a lack of consensus about its conceptual attributes (Smith, 2019).

In the research of cybervictimization, this term has been used when there is not a high repetition of online aggression or an imbalance of power between the victim and the aggressor/s. However, cybervictimization has also been defined as repeated negative behavior or attention over time by one person or a group towards another through information and communication technologies, such as threats and exclusion in social networks or unpleasant comments received by email (Gardella et al., 2017). In the present study, cybervictimization refers to students who have been attacked once or more by their classmates using insults, mockery, threats, false rumors, bullying and social exclusion through various electronic devices such as a tablet, computer (laptop or desktop), mobile phone, or game console.

Regarding the prevalence, there have been few studies that have reported the prevalence of cyberbullying and, specifically, of cybervictimization in the Primary Education stage in Spain since much of the research has focused on Secondary Education students. It is also the case in other countries (Smith, 2019). Likewise, there is a certain disparity in the prevalence rates that depend on the definition adopted, the methodology used and possible cultural differences (Smith, 2019). In addition, various studies have indicated that the confinement caused by COVID-19 led students to increase the time they use technologies with Internet access and, consequently, the number of victims of cyberbullying increased (Anccana et al., 2022; Gómez-León, 2021).

Currently, the prevalence of cybervictimization in Primary Education in Spain is between 6.6% (Estévez, 2021) and 13.4% (Machimbarrena & Garaigordobil, 2018) in students of 5th and 6th grade of Primary Education. Lower figures have also been obtained in a sample of students from 3rd to 6th grade of Primary Education, of which 4.9% recognized themselves as cybervictims (Sidera et al., 2021).

All in all, cybervictimization is a socially significant issue in early education (López-Pradas et al., 2017; Sidera et al., 2021), as its increasing prevalence can negatively impact health, well-being, and academic performance (Alzamil, 2021).

Thus, victims of cyberbullying present physical health symptoms such as fatigue, irritability, and sleep problems (Kowalski & Limber, 2013), as well as low levels of psychological well-being, emotional regulation problems, low self-esteem, isolation, social maladjustment (Extremera et al., 2018), antisocial behavior (Garaigordobil, 2017), anxiety (Doumas & Midgett, 2021), higher levels of depression (Zhang et al., 2020) and even higher levels of attempts and suicidal ideations (Iranzo et al., 2019).

For all these reasons, it is necessary to analyze those factors associated with cybervictimization that make it possible to prevent the involvement of students as victims of cyberbullying and to intervene early from the educational field with actions directed both towards students, families, and teachers. In this line, Görzig and Machackova (2015) have studied, through the socio-ecological approach, a series of risk and protection factors related to students, the family environment and other social aspects. In general terms, research on family variables has focused more on intrafamily communication, family climate, parental mediation, and parental educational styles, compared to sociodemographic variables, as reflected in the most recent systematic reviews of the literature (López-Castro & Priegue, 2019; Machimbarrena et al., 2019). Family sociodemographic factors play a significant role in minors' involvement in cybervictimization. While some of these factors have been studied in Secondary Education, it is necessary to also assess their influence in Primary Education.

Nikken and Schols (2015) found, in a sample of families in Early Childhood and Primary Education, that the parents's gender influences, along with other variables, the prediction of the presence of multimedia devices in the child's room. Specifically, fathers have indicated, more frequently than mothers, that their children have technological devices in their room. As is well known, the use of technology in the child's own room is associated with a greater risk of cybervictimization (González et al., 2016). In addition, Dedkova and Smahel (2019) pointed out in a sample of Czech families with children between the ages of 5 and 17, that mothers played a more active role than fathers in parental mediation strategies. These results agree with those found by Nikken and Schols (2015) who also detected differences based on the gender of the parents, with fathers applying supervision less frequently than mothers. In this sense, it should be taken into account that parental supervision is considered a protective factor against cybervictimization in students in Primary Education and Secondary Education (Martin-Criado et al., 2021).

Regarding the age of the parents and the cybervictimization of their children, Livingstone et al. (2017) found, in a sample of parents with children between 6 and 14 years old from 8 different European countries (N = 6400), that young parents presented greater active mediation, which is identified as a protective factor against cybervictimization (Wright, 2017). Adigwe (2021) has developed recent research on family sociodemographic variables, parental mediation and cybervictimization

experiences of minors from a sample of 1270 Nigerian families, with children between the ages of 13 and 18. The results reveal that restrictive mediation and co-use are positively associated with the age of the parents, being more frequent types of mediation in older parents, while technical mediation is negatively associated with said variable, so they are those younger parents tend to use it more frequently. It should be noted that restrictive parental mediation strategies are positively associated with cybervictimization (Wright, 2017).

Concerning the educational level of the family, Livingstone et al. (2015) revealed, in a sample of students in Childhood Education and Primary Education, that families with a lower educational level had more technological devices at home and felt less confident in their digital skills to carry out an effective active parental mediation compared to families with a high educational level. On the other hand, Nikken and Schols (2015) reported that the children of parents with a low educational level use technologies for a longer time and have technological devices in their own room, both variables being risk factors for cybervictimization (Sittichai & Smith, 2020; González et al., 2016). Finally, parents with a lower educational level use, more often, technical restrictions in the use of technological means by the child, than parents with a higher educational level who opt more frequently for active parental mediation, supervision, or co-use. In sum, Chen et al. (2018) discovered that children of parents with a low educational level have a higher risk of being cybervictims, in a sample of Chinese adolescents between 15 and 17 years old. Specifically, they indicated that a low educational level of the mother was associated with cybervictimization. Uludasdemir and Kucuk (2019) found that children of highly educated parents had a high probability of cybervictimization in a sample of children and adolescents between the ages of 12 and 17 in Turkey.

Regarding immigration background, Strohmeier et al. (2011) they affirmed that immigrant children in a Finnish sample of 7272 primary school students, aged 9-12, experienced more cybervictimization than their non-immigrant peers. Rodríguez-Hidalgo et al. (2019) found, in a sample of 25684 students from first to fourth grade, that immigrant students in Spain were more frequently cybervictims than native students in Secondary Education. Calmaestra et al. (2020) also pointed out that immigrant students in Secondary Education assumed the role of cybervictims more than natives in a sample of 33,303 adolescents from Ecuador (N = 10918) and Spain (n = 22385).

Another family sociodemographic factor associated with cybervictimization is family structure. Garmy et al. (2019) carried out research with an Icelandic sample of children aged 11, 13 and 15 (N = 11018), the results of which indicated that cybervictimization is associated with those students whose family structure did not allow them to live with their parents. Abdulsalam et al. (2017) also found, in a study of 989 students aged 12-14 in Kuwait, that children of divorced or widowed

parents were more likely to be cybervictims. Bevilacqua et al. (2017) found, in a sample of 6667 children and adolescents between the ages of 11 and 16 in the United Kingdom, that children from single-parent families were more likely to be victims of cyberbullying. Lastly, Chen et al. (2018) found, in research with 18341 adolescents aged 15-17 in China, that parents separated and divorced marital status was associated with cybervictimization of their children.

There have been few studies on cybervictimization that compare students from rural and urban environments as Kowalski et al. (2017) found. However, Rodríguez-Álvarez et al. (2022) recently indicated, in a sample of fifth and sixth grade students of Primary Education, that the percentage of victims is also significantly higher in schools in the rural context.

In short, it can be affirmed that there is scientific evidence that family sociodemographic variables play a prominent role in the cybervictimization of minors. However, there is a lack of specific research on family sociodemographic variables in a Spanish sample focused exclusively on the Primary Education stage, since the research is relatively recent. For all these reasons, it is necessary to know, exactly, the main risk factors that allow both prevention and early intervention in cybervictimization, being the educational stage of Primary Education the one that offers the greatest opportunities for primary prevention, since it is the key period of incursion in the use of technologies by minors (National Observatory of Technology and Society, 2022). Thus, cybervictimization is already observable in the last years of Primary Education (Rodríguez-Álvarez et al., 2022).

In this line, the objective of this study is to analyze the predictive capacity of sociodemographic parental variables (gender, age, immigration background, educational level, family structure and degree of rurality of the municipality of family residence) in the victimization of cyberbullying in fifth and sixth grade of Primary Education. Specifically, the following study hypotheses are proposed:

H1. The gender of the parent or legal guardian who answers the questionnaire influences the cyberbullying victimization of their children.
H2. The age of the parent or legal guardian who answers the questionnaire is related to the involvement of their children in cybervictimization.
H3. The educational level of the parent or legal guardian who responds to the questionnaire is associated with the risk of performance, by the minor, of the role of a victim of cyberbullying.
H4. The children of immigrant families are victims of cyberbullying more frequently than their native peers.
H5. Children of single-parent families are more frequently victims of cyberbullying.

H6. A high degree of rurality in the municipality of family residence increases the risk of minors being victims of cyberbullying.

H7. The sociodemographic parental variables (gender, age, immigration background, family structure, educational level, and degree of rurality of the municipality of family residence) are significantly associated with the cybervictimization of their children.

METHOD

In order to carry out this correlational and cross-sectional study, a two-stage sampling was carried out with the aim of selecting, first, the participating educational centers and, later, the families (fathers, mothers or legal guardians). The sample of centers consisted of 26 educational centers in total, being 17 Early Childhood and Primary Education Centers, 7 Private Centers and 2 Integrated Public Centers. Thus, the representation of population centers of different sizes (urban, semi-urban and rural) in Spain was achieved.

For the sample of families, participation was allowed to all those whose children were enrolled in the 5th and 6th grade of Primary Education in one of the 26 previously selected educational centers. 2094 families were invited and, finally, the participating sample consisted of 1169 families, guaranteeing the minimum sample size set at 381 families, $(1–\alpha)\% = 95\%$.

Regarding the most notable characteristics of the sample, 82% of the study participants were mothers or legal guardians and the remaining 17% were men. The relative who responded to the survey most frequently was the mother (80%), followed by the father (17%) and, to a lesser extent, both parents and legal guardians. The families were mostly between 41 and 50 years old (63%) and less frequently, between 30 and 40 years old (29%). With an even lower frequency, they were over 50 years old (5.1%) or under 30 (1.4%). In relation to the country of origin of the families, 13.6% stated that they came from other countries compared to the remaining 86.4% that indicated Spain. In addition, 38% have university studies, 27% Vocational Training, 18% primary studies, 15% secondary and 1% have no academic studies. Finally, the most frequent family structure was two-parent (70.5%), followed by single-parent families (12.9%) and extended families (12%).

Instrument

The instrument used to collect the information was a self-administered questionnaire that includes the sociodemographic profile of the parents or legal guardians (age, sex, country of origin, educational level, family structure, and municipality of residence) and the cybervictimization experiences of their parents. children, specifically, if the minors have been victims of any of the following types of cyberbullying: social exclusion, insults, threats, false rumors, teasing and intimidation during the six months prior to the study. The definition of cyberbullying proposed by Smith et al. (2008) which refers to the intention to harm the aggressor/s, the repetition, and the defenselessness of the victim due to an imbalance of power between her and the aggressor/s.

The validation of the instrument was carried out through the construct validity, the criterion validity, and the content validity, also evaluated by two experts in cybervictimization. To measure the reliability of the questionnaire, Cronbach's Alpha coefficient was found, obtaining an α value = .84. In short, an Exploratory Factorial Analysis of Principal Components with Oblimin rotation with Kaiser was carried out (KMO = .852, Barlett 's Sphericity Test = .000, total explained variance = 61%), which grouped the items based on the types of cybervictimization: teasing (.8), threats (.751), insults (.719), intimidation (.689), false rumors (.558) and social exclusion (.442). Although the α value corresponding to this last item of social exclusion was lower, all six items were considered valid according to the scientific literature. In addition, for simplicity for the analyses, the item was defined dichotomous: whether the minor has been (or has not) been a victim of any type of cyberbullying at least once in the six months prior to the study.

Process

The contact with the families was through the tutors of each group-class in each participating educational center, who distributed the questionnaires to the minors, inside sealed envelopes, so that they could deliver them to their parents or legal guardians and return them. to the center once completed within a maximum period of one week. To this end, the families were provided with brief instructions, located on the page prior to the start of the questionnaire, in which they were told that they should carefully read the presentation of the questionnaire and respond completely anonymously and sincerely, since, always, anonymity and confidentiality would be preserved, following the recommendations of the Code of Good Scientific Practices of The Spanish National Research Council.

Data analysis

All the qualitative variables studied were presented by absolute frequencies and percentages (see Table 1). The analysis of possible family sociodemographic risk factors for cybervictimization in Primary Education was carried out using binary logistic regression (Cox, 1970; McCullagh & Nelder, 1983), since the response variable that indicates whether the minor has been (or not) a victim of some type of cyberbullying, on at least one occasion during the previous six months, is a dichotomous variable.

Specifically, firstly, bivariate logistic regression models were implemented, in order to evaluate the influence, individually, of each variable as a possible risk factor for cybervictimization in Primary Education. Based on these models, the probability and risk of being a victim of *cyberbullying* were estimated by calculating the Odds ratio (OR), and its corresponding confidence interval for each of the sociodemographic family variables analyzed. Next, a logistic model was built to assess the combined impact, jointly, of various sociodemographic variables on the risk of cybervictimization. For the adjustment of this model, initially all the sociodemographic variables that had a p-value <.25 in the bivariate models (Hosmer et al., 2000), and following a stepwise procedure, the best predictive model was selected based on the Akaike Information Criterion (AIC), such that a model is better in terms of prediction the lower its AIC.

As in the bivariate models, the parameters of the multivariate model were contrasted using the Wald test, calculating the *OR* of the coefficients together with their confidence intervals and the respective p-values. In addition, the overall goodness of fit of the model obtained was evaluated using the Chi-square likelihood ratio test (Li & Babu, 2019), the absence of statistical significance of said test indicating that the quality of fit is good.

All statistical analyzes were performed with the statistical software *R* version 4.1.0 (R Core Team, 2020). The stepwise procedure was carried out with the *stepAIC* function of the *MASS* package of said program (Ripley, 2020), and a p-value <.05 was considered for statistical significance.

RESULTS

Of the total number of parents and legal guardians who responded to whether the minor had been a victim of cyberbullying, 115 (11%, 95% CI: 9% - 13%) stated that their child was a cybervictim on at least one occasion during the six months prior to the study. Table 1 shows the frequencies and percentages of each family sociodemographic variable in the groups of cybervictims and non-cybervictims.

Regarding gender, mothers and legal guardians have been the ones who have responded to the questionnaire more frequently than men, both in the case of cyber-victims and those who were not. However, the percentage of parents and legal guardians who have responded in the case of non-cybervictims has been higher. Related to age, both victims of cyberbullying and non-victims commonly have parents or legal guardians within the age range of 41 to 50. However, cybervictims more frequently present parents or legal guardians whose age is between 30 and 40 years. Regarding immigration background, cybervictimization has been higher in immigrant families compared to Spanish families.

The educational level of the parents or legal guardians shows greater differences between both groups, since the relatives of the non-cybervictims have, more frequently, university studies compared to those of the victims of cyberbullying. In addition, the parents, or legal guardians of the cybervictims have attended Vocational Education, Secondary Education or Primary Studies, more regularly, than those of the group not involved in cybervictimization. Regarding the family structure, the mode in both groups is two-parent families. However, non-cybervictims are members of two-parent families more frequently than cybervictims. For their part, victims of cyberbullying belong to single-parent families more frequently than non-cybervictims. Finally, respecting the degree of rurality of the municipality of family residence, it is evident that cybervictims reside in a rural environment more than non-cybervictims who live mainly in semi-urban environments.

Table 1

Distribution of frequencies of the sociodemographic parental variables in victims of cyberbullying and in non-cybervictims

Family variable	Not victim		Victim		Total	
	n	%	*n*	%	*n*	%
Gender						
Man	168	18%	13	12%	181	15%
Women	759	82%	99	88%	858	85%
Total	927	100%	112	100%	1039	100%
Age (in years)						
Less than 30	9	1%	2	1%	11	1%
Between 30 and 40	270	29%	41	36%	311	32%
Between 41 and 50	611	65%	68	60%	679	62%

Family variable	Not victim		Victim		Total	
	n	%	*n*	%	*n*	%
More than 50	47	5%	3	3%	50	5%
Total	937	100%	114	100%	1051	100%
Immigration background						
Yes	111	12%	13	22%	124	17%
Not	810	88%	47	78%	857	83%
Total	921	100%	60	100%	981	100%
Education level						
University studies	383	41%	31	27%	414	34%
Vocational training	254	27%	33	29%	287	28%
Secondary education	134	14%	27	24%	161	19%
Without studies or Primary Studies	167	18%	23	20%	190	19%
Total	938	100%	114	100%	1052	100%
Familiar structure						
Biparental	788	84%	84	74%	872	79%
Single parent	136	15%	28	25%	164	20%
Welcome center	1	<1%	0	0%	1	<1%
Extended family placement	12	1%	2	1%	14	1%
Total	937	100%	114	100%	1051	100%
Degree of rurality of the municipality of family residence						
Urban	298	33%	19	32%	317	33%
Semi-urban	329	37%	18	31%	347	36%
Rural	270	30%	22	37%	292	31%
Total	897	100%	59	100%	956	100%

Note. n: number of cases; %: percentage of cases.

The results of the bivariate analysis corresponding to the sociodemographic parental variables (Table 2) show that the educational level of the parents or legal guardians is a statistically significant univariate predictor ($p < .05$) of the risk of their children being victims of cyberbullying. Thus, parents or legal guardians who completed Secondary Education present a greater risk of cybervictimization of their children compared to those who have completed university studies. Regarding the family structure, although this variable was not statistically significant at the global level ($p > .05$), single-parent families reach almost double the risk of minors being victims of cyberbullying than traditional or two-parent families.

Table 2

Effect of sociodemographic parental variables on cybervictimization in Primary Education from the bivariate analysis of binary logistic regression

Gender	β	*SE*	*p* value	*OR*	95% CI
Gender					
Man					
Women	0.522	0.307	.089		
Age (in years)			**.251**		
Less than 30					
Between 30 and 40	- 0.381	0.800	.634		
Between 41 and 50	- 0.692	0.792	.383		
More than 50	- 1.248	0.983	.204		
Immigration background					
Not					
Yes	0.417	0.265	.116		
Education level			**.012***		
University studies				1	
Vocational training	0.473	0.263	.072		
Secondary Education	0.912	0.282	.001**	2.489	1.426 - 4.324
Without studies or Primary Studies	0.532	0.290	.067		
Familiar structure			**.058**		
Biparental				1	
Single parent	0.658	0.237	.006**	1.931	1.197 - 3.041

Gender	β	*SE*	*p* value	*OR*	95% CI
Welcome center	-11.327	535.411	.983		
Extended family placement	0.447	0.772	.563		
Degree of rurality of the municipality of family residence			**.396**		
Urban					
Semi-urban	-0.093	0.250	.711		
Rural	0.229	0.248	.355		

Note. β: coefficient; *SE*: standard error; *OR*: odds ratio; 95% CI: 95% confidence interval for the *OR*. *: $p < .05$; **: $p < .01$; ***: $p < .001$.

Based on the bivariate analyses, the variables initially selected to form part of the multivariate model were immigration background, education level, gender of the parent or legal guardian responding to the questionnaire and family structure.

The results of the multivariate analysis showed that the gender and educational level of the parent or legal guardian responding to the questionnaire and the family structure are sociodemographic parental variables significantly associated jointly ($p < .05$ in all cases) with the cybervictimization of their parents. children in Primary Education (Table 3). Specifically, when the mother or legal guardian responds to the questionnaire, the risk increases almost twice as compared to men ($p < .05$). In short, parents or legal guardians who studied Secondary Education as the highest educational level reach almost twice the risk of their children being victims of cyberbullying compared to those who studied at university ($p < .01$). Finally, students who belong to single-parent family structures present double the risk than those who are part of two-parent families ($p < .01$).

Table 3
Factors associated with cybervictimization in Primary Education. Multivariate logistic regression model

Gender	β	*SE*	*p* value	*OR*	95% CI
Gender					
Man Women	0.613	0.332	.027*	1.845	1.004 - 3.733
Education level			**.020***		
University studies				1	
Vocational training	0.454	0.269	.091		
Secondary Education	0.886	0.290	.002**	2.426	1.368 - 4.280
Without studies or Primary Studies	0.433	0.303	.153		
Familiar structure			**.013***		
Biparental				1	
Single parent	0.738	0.242	.002**	2.092	1.284 - 3.331
Extended family placement	0.529	0.793	.504		

Note. β: coefficient; *SE*: standard error; *OR*: odds ratio; 95% CI: 95% confidence interval for the *OR*. *: $p < .05$; **: $p < .01$; ***: $p < .001$.

DISCUSSION AND CONCLUSIONS

In this research, possible family sociodemographic risk factors for cybervictimization in Primary Education were studied. It should be noted that the studies published with an objective like ours are scarce, since most of the investigations on cybervictimization were carried out in Secondary Education (Smith, 2019) and have not analyzed the influence of family sociodemographic variables (López-Castro & Priegue, 2019; Machimbarrena et al., 2019). This fact highlights the interest of this study on family risk factors of a sociodemographic nature for cyberbullying victimization in Primary Education.

Regarding the proposed study hypotheses, firstly, the third hypothesis is verified (H3. The educational level of the parent or legal guardian who responds to the questionnaire is associated with the risk of performance, by the minor, of the role of a victim of cyberbullying), since minors belonging to families whose maximum educational level is Secondary Education register a higher risk of cybervictimization than families who have a higher level of education, such as university studies. These findings coincide with those reported by Chen et al. (2018) who identified that a low educational level of the mother is associated with the cybervictimization of her children in Secondary Education. In addition, their educational level also conditions the parental mediation that they carry out on the use of technologies by their children, since families with a lower educational level feel less confident in their digital skills to carry out effective active parental mediation compared to families with high educational level (Livingstone et al., 2015). Likewise, Nikken and Schols (2015) reported that parents with a low educational level allow their children to use technologies for longer and have technological devices in their own room, both of which are risk factors for cybervictimization (Sittichai & Smith, 2020; González et al., 2016). This phenomenon can be attributed to the influence of parental education on family values, skills, abilities, and knowledge towards formal education, which shapes educational practices and serves as a key factor in students' cultural capital.

Secondly, the fifth study hypothesis is partially confirmed (H5. Children of single-parent families are more frequently victims of cyberbullying). Although the family structure variable was not statistically significant globally at a significance level of 5%, significant differences were detected in single-parent households compared to two-parent households, the latter being the ones with the lowest risk. Our results support findings from previous studies, such as Garmy et al. (2019), who found a correlation between cybervictimization and students whose families don't live together, and Bevilacqua et al. (2017), who found that single-parent families had a higher likelihood of cybervictimization. Thus, the family structure plays a prominent role in cybervictimization both in Primary Education and in later stages. Previous research findings (Abdulsalam et al., 2017; Chen et al., 2018) also indicate that marital status of parents (specifically: widowed, separated or divorced) increase the risk of young people being victims of cyberbullying. This fact may have its origin in the different difficulties that single-parent families can present, such as the need for emotional and informational support, low family self-esteem, the risk of poverty and the lack of a social support network. Regarding parental mediation, parental supervision of the use of technologies and co-use could be more challenging for single-parent families since a single parent or legal guardian may encounter more difficulties in time management and family reconciliation.

Third, the seventh hypothesis is partially confirmed [H7. Sociodemographic parental variables (gender, age, immigration background, family structure, educational level, and degree of rurality of the municipality of family residence) are jointly significantly associated with the cybervictimization of their children]. In fact, gender, the maximum educational level of the parents and the constitution of the family home are statistically significant predictors ($p < .05$) jointly of cybervictimization in Primary Education. In this sense, the statistical non-significance of the Chi-square likelihood ratio test indicates that the multivariate model that has been obtained presents a good quality of fit and predictive reliability. Therefore, family structures that are made up of children and mothers, whose maximum educational level is Secondary Education, present a greater risk of them being victims of cyberbullying. This fact could be justified by the fact that there is a greater demand in the task of active parental mediation, parental supervision, and co-use for a single parent who, in addition, having a low educational level, will feel less confident in their digital skills to perform this task (Livingstone et al., 2015).

Finally, even though there is previous scientific evidence on the relationship between cybervictimization and the sociodemographic variables of the parent or legal guardian (gender, age, immigration background and degree of rurality of the municipality of family residence), in this study, it was not have found sufficient scientific evidence to support such hypotheses, therefore having to assume the corresponding null hypotheses of no association.

For all these reasons, it can be concluded that the research carried out identifies family sociodemographic factors associated, both jointly and individually, with the risk of cyberbullying victimization in Primary Education. Thus, the results obtained show the great importance of the educational level of the families and the family structure as risk factors for cybervictimization in Primary Education, agreeing with previous research carried out in Secondary Education.

These results are very useful when designing preventive strategies for cybervictimization to avoid the negative consequences on academic performance and, especially, on the health and general well-being of the minors involved (Alzamil, 2021). To elaborate proposals for educational intervention in cybervictimization, we can consider a socio-ecological or systemic approach (Bronfenbrenner, 1979). This theory explains the development of minors based on the interrelation of various social systems from the family and the peer group to local government and culture. In this way, prevention and intervention in cyberbullying should not only focus on minors but also on the various social systems in which children develop, in order to optimize the effectiveness of educational intervention. More specifically, an intervention proposal, from this theoretical approach, could be separated into three axes of action to address all members of the educational community, following the models of whole policy: students, families, and teachers/school.

Focusing on families, Gairín et al. (2013) mentioned that families should become aware of the seriousness of the problem, monitor the number of hours their children consume content, and pay attention to possible behavioral changes. To optimize the effectiveness of educational intervention, the focus should be on single-parent families with low educational levels, providing preventive support to regulate their children's use of online technologies and reducing frequency and number of devices. Specifically, the following dimensions could be included: 1) awareness of cybervictimization, 2) digital skills, 3) parental mediation skills, 4) parenting styles, 5) assertive communication, and 6) family involvement.

Educational intervention in these dimensions could help families to understand the risks that cybervictimization presents to the health and general well-being of their children. In addition, their digital skills could be improved, which would help them to increase their confidence when performing parental mediation. In this sense, it would also be positive if they develop specific parental mediation skills to regulate the use of technologies that their children make at home. In fact, active parental mediation works as a protective factor against cybervictimization and is also much more important than mediation that can be carried out from schools (Halpern et al., 2021). It would also be appropriate for them to know and be able to exercise a democratic parenting style, based on a high degree of affection and control, since it has been identified as a protective factor against cybervictimization. In short, the development of communication skills by families could be promoted so that they avoid communication deficits, punishment and intrafamily violence, since they present a greater risk of cybervictimization for their children. This educational intervention proposal aims to engage families in their children's digital and school life by providing support, fostering assertive communication, and establishing clear, stable, and agreed rules, which can help prevent cybervictimization.

Regarding the limitations of the study, we can identify the use of a self-administered questionnaire, since it would be positive to use other types of complementary instruments that allow the triangulation of the information collected. On the other hand, the cross-sectional nature of this study can be recognized as another limitation since it could be carried out longitudinally to find out how these variables affect minors based on their age.

Future research should include qualitative studies on single-parent families to gain a deeper understanding of their needs, to ensure the success of preventative programs. Likewise, cross-sectional studies on the influence of these sociodemographic variables on the perpetration of cyberbullying would be of great interest to identify possible differences depending on the roles of cyberbullying. In this sense, it would be positive to have a sample whose distribution was equitable according to gender. Finally, a longitudinal study that analyzes the influence of these variables in a group of single-parent families over a period of time that allows us to know how this relationship

evolves depending on the age of the minors, would be useful to adapt the strategies of prevention of the phenomenon.

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Students at risk: how do students' perception of socio-familiar characteristics condition their attitudes and behaviour in the class?

Riesgo de abandono escolar: ¿cómo influyen las características sociofamiliares percibidas por los estudiantes sobre sus actitudes y comportamiento en el aula?

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ABSTRACT

Dropping out of school early is a major social problem that needs to be addressed, given the negative consequences for the individual, as well as the high social costs involved. Combatting early school leaving is one of Europe's Sustainable Development Indicators and a challenge for many schools. We present the results of the project "Pupils at risk of dropping out" carried out in Andalusia (Spain). This community has a very high dropout rate (21.6% on average) compared to the European average (around 10%). We analysed the risk factors for school dropout among pupils in this community by relating their attitudes and

behaviour in the classroom to their socio-family characteristics. The methodology used was quantitative. Two scales were administered to a representative sample of 1426 students: one measuring students' perceptions of socio-familial characteristics and the other gauging pupils' perceptions of student attitudes and behaviour in the classroom, both based on the work of Fortin *et al.* (2006) and Lessard *et al.* (2008). The main results point to the relevance of family characteristics in student behaviours and attitudes, with family involvement not being as influential as a predictor of such behaviours. The main conclusion we draw is that socio-family characteristics influence the attitudes and behaviour of pupils in the classroom, perceiving the importance of education within the family as the main characteristic.

Keywords: students at risk, dropout, compulsory secondary education, socio familiar characteristics, construct validity

RESUMEN

El abandono escolar temprano supone un importante problema social al que hay que hacer frente dadas las consecuencias negativas que produce para el individuo, así como los altos costes sociales que conlleva. Combatir el abandono es uno de los indicadores de Desarrollo Sostenible de Europa y un reto para muchos centros educativos. Presentamos los resultados del proyecto "Alumnado en riesgo de abandono" desarrollado en Andalucía (España). Esta comunidad presenta una tasa de abandono muy alta (21.6% de media) si la comparamos con la media europea (en torno al 10%). Analizamos los factores de riesgo de abandono escolar del alumnado de esta comunidad relacionando sus actitudes y comportamientos en el aula respecto a las características sociofamiliares. La metodología empleada ha sido cuantitativa. Se aplicaron dos escalas a una muestra representativa de 1426 estudiantes: una mide las percepciones de los estudiantes sobre las características sociofamiliares y la otra, la percepción de los estudiantes sobre las actitudes y comportamiento del alumnado en el aula; ambas elaboradas a partir de los trabajos de Fortin et al. (2006) y Lessard et al. (2008). Los principales resultados apuntan a la relevancia que las características familiares tienen sobre los comportamientos y actitudes del alumnado, no teniendo tanta influencia la implicación familiar como un predictor de dichas conductas. Como principal conclusión extraemos que las características sociofamiliares influyen en las actitudes y comportamiento del alumnado en el aula percibiendo como principal característica la importancia de la educación en el seno familiar.

Palabras clave: estudiantes en riesgo de abandono, abandono escolar temprano, educación secundaria obligatoria, características sociofamiliares, validez de constructo

INTRODUCTION

Truancy, disruptive behaviour, family and personal difficulties, failing grades and repeating grades (repeated failure) are the prelude to early school leaving (hereafter referred to as ESL). This is a progressive disengagement process. It is not something that happens suddenly (Robin & Burger, 2020). Examining the above-mentioned concepts, the term school failure is repeatedly the subject of discussion. For Fernández Enguita *et al.* (2010), failure has a denotative and connotative value. The denotative is due to the fact that there is no clear definition of it, as for some it would consist of not completing Compulsory Secondary Education (ESO), and for others, not completing post-compulsory secondary education, while all forms of failure, repetition or delay could be included; that is, partial failures can mark a difficult path to success. For example, in terms of school year repeaters in Andalusia, who account for 33.3%, a value well above the average for OECD countries with 11.4% (PISA, 2019). The connotative would entail the disqualification and even stigmatisation of the pupil, blaming them exclusively, with the consequent de-responsibilisation of the institution. This failure is sometimes due to serious absenteeism processes. This refers to the regular and continuous non-attendance of pupils in basic and compulsory education at the school they attend, without illness or major cause to justify their absence. According to data from the PISA Report 2015 (OECD, 2016), the percentage of students who say they have missed at least one day of school without justification is 25% in Spain, compared to 19% on average in OECD and EU countries. Failing at school, failing exams and sometimes not being allowed to progress to the following year, and missing classes, are all factors that contribute to the process of "disengagement", which often ends up with students dropping out of school, as reported in previous studies (González-Losada *et al.*, 2015). The terms "disengagement", "dropping out" or disaffection have been widely used in studies in the English-speaking sphere. This is evidenced by the plethora of scientific articles that use the terms. Specifically, according to González and Bernárdez-Gómez (2019), there are students who become disengaged and end up dropping out. This phenomenon is well documented and has a complex and multifaceted nature, in which multiple contexts (school, classroom, families, community) and people (pupils, teachers, classmates, family members) interrelate, and in which factors of a very different kind (personal, social, cultural, economic, academic, school, etc.) intervene. These authors build on previous work such as that by Patton and Price (2010), in which they distinguish between students who are "visibly disengaged" (disruptive, apathetic and disengaged) and those who are disengaged, albeit not obviously (students who are adept at achieving high grades, despite lacking interest and aspiration). In similar terms, Sodha and Guglielmi (2009) distinguish between active disengagement (visible and manifest in low

achievement, negative attitudes, misbehaviour or avoidance of participation) and passive disengagement (students who passively withdraw from their education, distancing themselves cognitively and emotionally by being less visible). Notable among these works is the study by Fredricks *et al.* (2019) in which they review school commitment/engagement.

Having clarified these differences between concepts, we need to address ESL. According to the recommendations of the Council of the European Union of 28 July 2009 (Council of the European Union, 2011) on policies to reduce early school leaving, they specify that: "The term 'early school leavers' is used in relation to people who leave education and training with only lower secondary education. …" (p. 1). The dropout rate is calculated from data provided by the Economically Active Population Survey (EAPS) of the National Statistics Institute (INE), taking as a reference the International Standard Classification of Education (ISCED), ensuring comparability with results from other countries (INE, 2015). Thus, according to the EAPS, the percentage of 18-24 year olds whose highest level of education corresponds to one of the ISCED levels 0 (Pre-school), 1 (Primary), 2 (Compulsory Secondary) or 3 (Post-compulsory), short cycle and who are not studying or training in the four weeks prior to the survey, are dropouts (thus ruling out levels 3.A, Baccalaureate; 3.B, Intermediate Level Training Cycles; and 3.C, Occupational Training, which pursues specialisation in work skills.) (INE, 2015). The same definition can also be found in Eurostat (2020). One of the priority objectives of the Europe 2020 strategy is that the value of this indicator should not exceed 10%. Spain, in 2019, presented an ESL rate of 17.3% (21.4% men and 13% women), far exceeding the rates of other European countries. In this sense, "the level of early school leaving remained at very high levels (around 30%) between 2000 and 2008, without any improvement until 2009, when the indicator began to decrease" (Bayón-Calvo, 2019, p.50). In the present study, the dropout rate is 21.6% on average (16.9% for women and 26.1% for men), Ministry of Education and Vocational Training, 2020a). Given the magnitude of the problem, within the Sustainable Development indicators, the issue is monitored. Specifically, the 2030 Agenda for Sustainable Development (INE, 2021) includes the goal of ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all, and the corresponding indicator (4.1.2. Completion rate for primary and secondary education).

In parallel, the results of studies such as the Trends in International Mathematics and Science Study (TIMSS), which assesses the mathematical and scientific competence of pupils in Primary Education (PE) and year 2 of Compulsory Secondary Education (ESO), or those of the Programme for International Student Assessment (PISA), carried out by the Organisation for Economic Co-operation and Development (OECD), highlight the poorer performance of Spanish students compared to the average for OECD countries (OECD, 2018, 2019).

All these circumstances have serious individual and social consequences (Lessard *et al.*, 2010). For example, these students have less access to the labour market, lower salaries and a higher risk of exclusion (Latif *et al.*, 2015; UNESCO, 2015). This leads to high costs, a high rate of unskilled population and lower productivity, given the low level of education. This vulnerability, victimisation and exclusion in young early leavers is higher than in other age groups, according to international studies (Escudero *et al.*, 2013; European Union, 2013; Sañudo Guerra, 2022).

In this context, it is necessary to analyse Spanish secondary schools, as they are the object of our study and the educational stage where the risk of dropout is highest. Previous research has identified issues that strongly influence the risk of ESL: teachers abuse traditional methodologies (Rué, 2006); students do not recognise the usefulness of their studies and tend to get bored in their classes (Moeller *et al.*, 2020); they think that marks or grades are not important (González-Losada *et al.*, 2015; Tarabini y Curran, 2015); pupils do not feel included and this conditions their behaviour in terms of school regulations (Strayhorn, 2019; Johnson *et al.*, 2020); nor do they recognise the centre as a place of their own and problems are identified in relations between peers (González-Falcón *et al.*, 2016); the degree of commitment is low this conditions their performance (Fredricks *et al.*, 2019) and relationships with teaching staff (Martin & Collie, 2019; Skinner *et al.*, 2008).

Janosz *et al.* (1997) identified how the main predictors of school dropout in the last quarter of the 20th century, i.e. school, family, behavioural, social and personality variables, can be grouped into three main factors: personal, socio-family and school. These conclusions are reaffirmed in subsequent studies, most of which are also quantitative, and others based on a qualitative methodology (Aristamuño, 2009; Calero, 2006; Janosz *et al.*, 2008; Lessard *et al.*, 2008; Suberviola, 2021). In the personal scope, research identifies skills, needs, interests and motivations as influencing the risk of dropout. Lower school commitment and participation are directly related to a higher likelihood of dropping out. Montecinos (2018) emphasised the lack of school participation and the absence of alternative routes to further studies. McGrath and Van Bergen (2015), focusing on pupil behaviour and temperament, they claim that students who are disruptive, aggressive or antisocial in class are at high risk of dropping out.

Janosz *et al.* (2008), considered that low engagement and unstable school records point to a high risk of dropping out and often coincide with personal, family or social problems. Gubbels *et al.* (2019), in turn, identified risk factors related to the characteristics of young people such as age (the older they are, the higher the risk of absenteeism and consequently of failure and dropping out).

The second group of risk factors is linked to the family: low socioeconomic levels (Andalusia has one of the highest unemployment rates in the national scope

-INE, 2022-), psychosocial factors of the family and family-educational relationships (Suberviola, 2021), the attitude of parents towards studies, the type of language and communication existing between them; the promotion of reading, future expectations or the value they place on education (Janosz *et al.* 2008; Marchesi, 2003; Vitaro *et al.*, 2001). The family can be expected to support the optimal development of children, given its educational influence as an agent of socialisation (Torío López, 2004 and Fajardo Bullón, *et al.*, 2017). Peña *et al.* (2016) stated in their study that parental lack of concern is the most important element in school dropout. In the case of poorly motivated and committed pupils, their parents further decrease their involvement in their education, and their teachers find it more difficult to establish positive relationships with them. These problems are due, among other variables, to the paths that the student has followed. The involvement of families and the backing and support of the school institution are therefore essential when students are at risk. Hence the importance of establishing connections between family and school (Álvarez and Martínez, 2016).

Other studies highlight how increasing parents' educational attainment decreases the likelihood of dropout (Cerruti & Binstock, 2004; Binstock & Cerruti, 2005). Research such as that of Battin-Pearson *et al.* (2000) or Fortin *et al.* (2004) concludes that children who perceive little cohesion, conflicts, communication problems, lack of organisation in the family or who come from broken families, are more at risk of dropping out than other pupils Gubbels *et al.* (2019) extended these problems to the characteristics of the parents by referring to psychological problems or difficulties at work.

The third group of factors are social and school aspects. They are usually focused on the role of teachers (Janosz, *et al.*, 2008; Lessard *et al.*, 2008, 2010, Sancho & Esteban, 2007). Some of the causes that most clearly intervene in student performance are also identified, such as the average socioeconomic level of the school, or repetition in previous years. This study by Gubbels *et al.* (2019) identified the features of their schools as determining factors (very high ratios, high repetition rates, low teacher quality); or the characteristics of their peer group (antisocial behaviour, truancy, delinquency, etc.).

In view of the above, and given the high dropout and unemployment rates in the Andalusian community, this study was carried out in order to examined in depth some of the risk factors for dropout. In this paper, we analyse the socio-familial characteristics and their influence on the behaviours and attitudes of Andalusian secondary school pupils, presenting the results of the validation of two scales of an ad hoc instrument.

METHOD

The research presented is quantitative and hypothetical-deductive, following a survey method and cross-sectional design. Although the research was more extensive (two questionnaires were administered: one for teachers and one for pupils). The overall aim of this work is to confirm the influence of socio-familial characteristics on students' attitudes and behaviour in the classroom. As specific objectives, we propose:

- To analyse secondary school students' perceptions of their socio-familial characteristics, attitudes and behaviour in the classroom.
- To assess the construct validity of the "socio-familial characteristics" and "students' attitudes and behaviour in the classroom" scales.
- To confirm the influence of socio-familial characteristics on students' attitudes and behaviour in the classroom.

The initial hypothesis was formulated as follows: socio-familial characteristics influence students' attitudes and behaviour in the classroom.

Sample

The sample used focuses on the educational community of 3rd and 4th year of Compulsory Secondary Education (ESO) in Andalusia. The sample consists of a total of 1426 pupils (N: 160.000; p<0,01; sampling error: + 4%) from 16 challenging ESO schools. The selection of the schools was intentional and carried out by the Andalusian Ministry of Education. The selection criteria were absenteeism and failure rates above the average for Andalusian schools and high rates of sanctions for disruptive behaviour. This made it easier for researchers to access and identify the schools, as these data are not publicly available.

Regarding the sample characteristics, 94.7% came from state schools (1350) compared to 5.3% (75) from schools, i.e. centres whose administration is mainly public but which are privately run. The selected sample were in 3rd (52.5%) and 4th (47.5%) year of ESO. As for gender, 49.2% were men and 50.5% were women, thus achieving a balanced representation in both groups. The mean age was 14.98 years, with a standard deviation (SD) of 0.96.

T-tests were carried out to study the differences in the sample distribution, with the following results: in terms of the educational level of parents, in general, no significant differences were found between the type of studies of parents (p=.38). However, there was a tendency for mothers' educational attainment to be higher in line with university education (Figure 1). This is not the case for tertiary education/ vocational training, where there is a higher presence of fathers than mothers.

Figure 1
Parent study levels

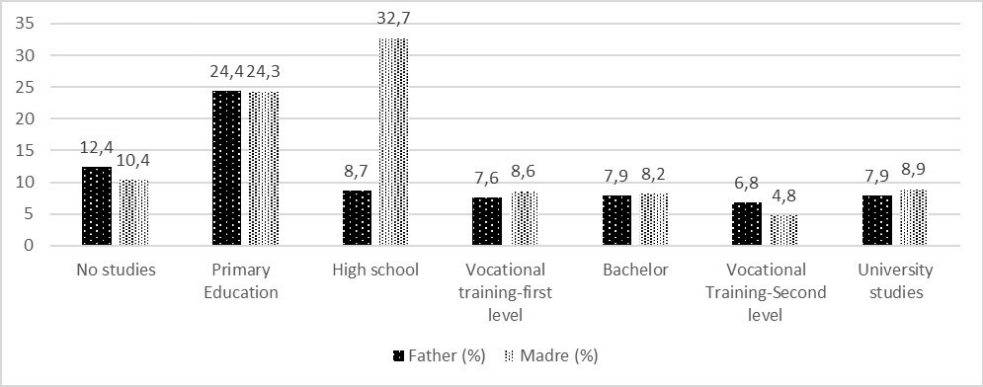
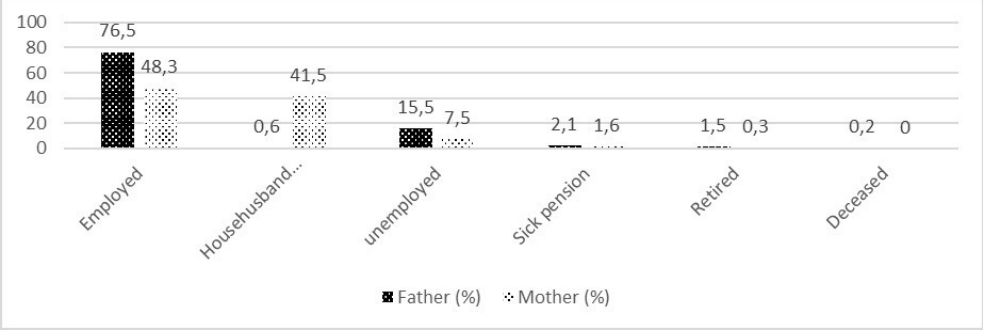


Figure 2
Employment status of parents



With regard to employment status, as shown in Figure 2, there are significant differences between the employment status of fathers and mothers (P≤.001), with a higher percentage of fathers in paid work (76.5%) than mothers (48.3%), with

mothers devoting more of their time to housework (41.5%) than fathers (0.6%). There is also a higher percentage of unemployed fathers (15.5%) than mothers (7.5%).

Finally, in reference to some student performance indicators, 58.9% (840 pupils) had never repeated a year, 27% had repeated one year (385 pupils), 12.3% had repeated two years (176 pupils), 0.9% had repeated three years (13 pupils) and 0.1% had repeated four years (1 pupil). The average number of subjects failed in the previous academic year was 1.27 (SD= 2.08), with considerable variability in the responses to this item. As for the type of subject repeated (Table 1), the highest percentages are accumulated in Mathematics (23%), English (18.9%), Spanish Language and Literature (18%), Biology and Geology (15.5%), Social Sciences (15.2%), Physics and Chemistry (10.5%), Technology (9.7%) and French (6.5%). The lowest percentages were concentrated around the subjects of Plastic and Visual Arts (3.2%), Civic Ethics (3%), Music and Physical Education, with 2.6% respectively, and Computer Science (0.8%).

Table 1
Repeated subject frequency and percentages

Failed subjects	Yes		No	
	Frequency	%	Frequency	%
Mathematics	328	23	1098	77
English	270	18.9	328	81.1
Spanish Language	257	18	1169	82
Physical Education	37	2.5	1389	97.4
Plastic and Visual Arts	45	3.2	1381	96.8
Biology and Geology	221	15.5	1205	84.5
Physics and Chemistry	150	10.5	1276	89.5
Social Sciences	217	15.2	1209	84.8
Technology	138	9.7	1288	90.3
Music	37	2.6	1389	97.4
Civic Ethics	43	3	1383	97
Computer Science	12	0.8	1414	99.2
French	93	6.5	1333	93.5

Instrument

When designing our instrument, we took other scales already validated into account. We reviewed the work of Fortin *et al.* (2006), who studied risk factors around three main dimensions: personal, family and school, with pupils in 7th grade (equivalent to 1st year of ESO); the work of Lessard *et al.* (2008; 2010), focused on school factors, with pupils who had dropped out of school. The work by Janosz *et al.* (2000), which analysed school, family and peer relationship factors to predict dropout risk; Vitaro *et al.* (2001), who used questionnaires to analyse family factors; and those of Archambault *et al.* (2009a, 2009b), studying the relationship between pupil participation and engagement with the school institution in secondary schools. All these research studies served as our references when gathering information on the incidence of risk factors. What they all show is the complexity of the problem of dropping out and the heterogeneity of the individuals at risk, as well as the different weight that each of the factors has in the school leaving process.

In our study, two scales were applied: one measuring pupils' perceptions of socio-familial characteristics (Annex I) and the other gauging their perceptions of pupils' attitudes and behaviour in the classroom (Annex II).

The scales were evaluated by a group of experts who assessed the relevance of the content and clarity of the wording of the items and made some changes to the wording of the items. Subsequently, a pilot study was carried out in a secondary school in the city of Huelva, which serves a socially disadvantaged population and deploys different actions to ensure access, promotion and permanence of these students in the education system. The outcomes obtained in terms of the construct validity of the scales "socio-family characteristics" and "student attitudes and behaviour in the classroom" are shown in the results section.

The socio-familial characteristics scale consists of 12 items, obtaining a Cronbach's alpha of .52, a low initial value but acceptable in the early stages of exploratory studies. (Nunnally, 1987). However, the items were reviewed through the corrected total correlation, and no item was identified whose removal increased Cronbach's alpha significantly compared to that obtained. The pupil classroom behaviour scale reached an alpha of .78 for 20 items. Each of these items is measured on a Likert-type scale from 1 to 5 (1 being never and 5 always).

Procedure

Given that the Education Administration (General Delegation of Education of the Andalusian Regional Government, the highest authorities responsible for this area in this community), carried out the selection of the schools with the criteria specified above and notified them of their participation in the project. The procedure for application of the instrument was simple. We contacted them and arranged the appointments with the centres, as the surveys were applied in person. The questionnaires were administered on paper. The research team travelled to the different Andalusian provinces and schools selected. The questionnaires were administered and collected on the same day, going through the different classrooms. This ensured anonymity and data protection.

Prior to implementation, two meetings were held with the General Delegation of Education in order to obtain ethical approval for the process. At the first meeting, the project, its objectives and the procedure to be applied were presented. The instrument was left to be studied by the Delegation's Ethical Committee. After this and at the second meeting, we were given permission to apply the procedure, as well as the list of selected schools.

For the data analysis, an exploratory factor analysis of each variable was carried out using the two scales proposed in this study, with the aim of analysing the students' perception of the socio-familial characteristics and the attitudes and behaviour of pupils in the classroom. The means and standard deviations were obtained for each of the variables, and homogeneity was studied by means of the corrected item-total correlation, allowing us to analyse whether the items are related to each other, i.e. they measure the same variable, as well as their ability to discriminate between the items. The response options for the Likert-type items were grouped into three levels: low (1-2), medium (3) and high (4-5), in order to obtain their percentages.

To gather evidence of the construct validity of the "socio-familial characteristics" and "student attitudes and behaviour in the classroom" scales, an exploratory study was carried out, using the maximum likelihood estimation method and Varimax rotation to analyse the factor structure of each scale. The internal consistency of the complete scale and the resulting subscales of the factor analysis was analysed using Cronbach's alpha.

All analyses were performed with the SPSS data statistics software, version 17.

Finally, to confirm the influence of socio-familial characteristics on pupils' attitudes and behaviour in the classroom, structural equations were used through the AMOS v.18 programme, including in the model the factors extracted in the exploratory analysis, adopting as a reference the criteria established by Byrne (2010) and Kline (2010) (CMIN/DF between 2 and 5, CFI and IFI > .9, RMSEA < .06 and HOELTER > 200).

RESULTS

The results are presented in response to the study objectives.

Objective 1. To analyse students' perceptions of socio-familial characteristics and pupils' attitudes and behaviour in the classroom

Tables 2 and 3 show the items that make up the socio-familial characteristics and student attitudes and behaviour in the classroom scales for each of the items. Mean and standard deviations, the homogeneity through the corrected item-total correlation and the response percentages are analysed according to the three levels of grouping: low (1-2), medium (3) and high (4-5).

There is sufficient variability for all items, as the minimum and maximum available values were reached for all items. The results obtained are described below (Tables 2 and 3).

Table 2

Descriptive analysis of the socio-family characteristics scale

Items	$\bar{X}$	SD	Cr-IT	Low 1-2	Average 3	High 4-5
D7. My family thinks that studying is very important	4.84	.58	.31	1.9%	2.2%	95.9%
D2. My family is concerned about my grades	4.67	.76	.34	3.8%	4.5%	91.7%
D9. My family is confident in my ability to succeed in my studies	4.45	.95	.30	7%	7.2%	85.9%
D8. My family speaks well of the teachers and the school	4.16	1.07	.35	10.3%	12.5%	77.3%
D1. I have enough time to study	3.78	1.07	.28	14%	21.6%	64.4%
D6. My family gets angry when I skip class	3.14	1.71	.06	43.6%	6.8%	49.5%
D4. My family goes to the school to talk to the teachers	3.05	1.32	.25	44.9%	18%	37.1%
D7. My family thinks that studying is very important	4.84	.58	.31	1.9%	2.2%	95.9%

Items	$\bar{X}$	SD	Cr-IT	Low 1-2	Average 3	High 4-5
D2. My family is concerned about my grades	4.67	.76	.34	3.8%	4.5%	91.7%
D9. My family is confident in my ability to succeed in my studies	4.45	.95	.30	7%	7.2%	85.9%
D8. My family speaks well of the teachers and the school	4.16	1.07	.35	10.3%	12.5%	77.3%
D1. I have enough time to study	3.78	1.07	.28	14%	21.6%	64.4%
D6. My family gets angry when I skip class	3.14	1.71	.06	43.6%	6.8%	49.5%
D4. My family goes to the school to talk to the teachers	3.05	1.32	.25	44.9%	18%	37.1%
D10. My family ask me to help them in their work	2.36	1.28	.03	64.5%	14.5%	21%
D5. My family helps me with my homework assignments	2.35	1.26	.25	68.1%	11.8%	20.1%
D12. Many of my friends are thinking about giving up studying	2.34	1.25	.17	62.5%	19.2%	18.2%
D11. In my neighbourhood there are bad relations between young people	1.63	1.08	.21	85.3%	6.5%	8.2%
D3. Someone in my family has a major drug or delinquency problem	1.28	.89	.23	93.4%	1.3%	5.3%

Note. All items reached the minimum value (1) and maximum value (5). X = Mean; SD = Standard Deviation; Cr-IT= Item-total correlation corrected.

With regard to socio-family characteristics, the main ones perceived are those related to the importance of education in the family environment, such as: "my family thinks that studying is very important" (95.9%), "my family are concerned about my grades" (91.7%), "my family is confident of my ability to succeed in my studies" (85.9%), "my family speaks well of the teachers and school" (77.3%), "I have enough time to study" (64.4%).

In contrast, there is little presence of those items related to lack of family involvement, such as "my family goes to the school to talk to the teachers" (37.1%) or "my family helps me with my homework assignments" (20.1%); nor is there a perceived presence of those characteristics of the social environment, such as "many of my friends are thinking about giving up studying" (18.2%) or "in my neighbourhood there are bad relations among young people" (8.2%).

As for the homogeneity index, corrected item-total correlation was positive for all items, after inverting the items: D3, D11, D12 and D10, so that they contribute in the same sense as the measurement by the questionnaire. We found items whose values are lower than <0.2, D6, D10 and D12, and decided to rule out these items, following the theoretical recommendations (Frías-Navarro, 2019).

Table 3

Descriptive analysis of the pupils' attitudes and behaviour in the classroom scale

Ítems	$\bar{X}$	SD	Cr-IT	Low 1-2	Average 3	High 4-5
B13. I think getting good grades is very important	4.51	.92	.44	5.9%	6.9%	87.2%
B8. I get on well with my colleagues	4.47	.92	.44	5.6%	4.2%	90.1%
B14. I feel good about myself	4.13	1.06	.20	10.2%	12.4%	77.4%
B11. I think I'm just another pupil, with the same options to pass as my colleagues	4.13	1.26	.39	14.6%	9.6%	75.8%
B9. I get on well with my teachers	4.13	.99	.49	8%	12.9%	79.1%
B2. I pay attention in class	3.96	.97	.61	8.6%	15.5%	75.9%
B19. Teachers encourage me to study and appreciate the effort I make	3.48	1.33	.42	28.8%	16.1%	55.1%
B12. I like studying	2.67	1.28	.31	47.7%	23.6%	28.7%
B15. I feel able to influence others	2.63	1.32	.07	51.8%	19.7%	28.5%
B18. I like the school	2.56	1.30	.49	51.3%	21.5%	27.2%
B20. My teachers think my class is one of the worst	2.53	1.45	.28	61.1%	10.9%	28%
B3. In class I feel nervous, tense and stressed	1.99	1.06	.35	78.6%	10%	11.4%
B6. My classmates annoy me	1.89	.95	.21	84.5%	8.2%	7.3%

$\bar{X}$	SD	Cr-IT	Low 1-2	Average 3	High 4-5	Alto 4-5
B10. I think studying is a waste of time	1.60	1.01	.53	88.5%	3.7%	7.8%
B1. I come late to class	1.60	.87	.37	90.1%	3.6%	5.4%
B16. I feel isolated	1.44	.89	.29	90.4%	4.7%	4.8%
B17. I usually skip classes without justification	1.36	.77	.24	94.2%	2%	3.8%
B4. I deliberately disturb the class by behaving incorrectly towards the teacher	1.33	.68	.42	94.6%	3.1%	2.3%
B5. I pester my classmates	1.31	.61	.38	96.2%	2.4%	1.4%
B7. They throw me out of the class	1.23	.59	.42	96.7%	1.8%	1.4%

Note. All items reached the minimum value (1) and maximum value (5). X = Mean; SD = Standard Deviation; Cr-IT= Item-total correlation corrected.

In terms of classroom attitudes and behaviour, there is a lower proportion of disruptive acts in class. All the items listed in this time mentioned received very low scores: "They throw me out of the class" (1.4%); "I pester my classmates" (1.4%); "I deliberately disturb the class" (2.3%); "I usually skip class" (3.8%); "I feel isolated" (4.8%); "I come late to class" (5.4%).

Pupils scored high on those items that highlight the value of education (B13, B11, B14, B9, B2), in all of which more than 50% scored high (4-5).

On the other hand, different opinions are observed with regard to positive attitudes towards education; "I like studying" (low: 47.7%; average: 23.6%; high: 28.7%); "I like the school" (low: 51.3%; average: 21.5%; high: 27.2%).

The corrected item-total correlation is positive for all items. To this end, the items were reversed: B1, B10, B16, B3, B20, B4, B7, B17, B6, B5, B15, thus contributing in the same direction in the measurement. The decision was taken to remove item B15, whose value was less than <0.2 (Frías-Navarro, 2019).

Objective 2. To assess the construct validity of the "socio-familial characteristics" and "students' attitudes and behaviour in the classroom" scales

For the factor analysis, items that presented difficulties in the previous analysis were removed and items with factor loadings below .30 were eliminated, as these items are considered to discriminate weakly (Nunnally y Bernstein, 1995). The analyses were relevant given the high KMO indices of the scales, ranging from .707 to .842, which allows for the convenience of performing the factor analysis. On the

other hand, Bartlett's test of sphericity shows the applicability of the factor analysis of the scales (significance index <.001). The resulting factor structure is presented in table 4.

Table 4

Exploratory factor structure of the socio-familial characteristics scale

KMO: .707; Bartlett, χ^2 = 1109.455; gl= 36; P<0.001			
Items	Factor		
	1	2	3
D7	.548		
D8	.476		
D9	.461		
D2	.451		
D5		.606	
D4		.535	
D1			
D11			.559
D12			.535

For the "socio-familial characteristics" scale, the results yielded a total of 3 factors explaining 51.77% of the variance. A first factor refers to the "importance" that the family gives to their children's education, explaining 25.11% of the variance and consisting of four items (D7, D8, D9, D2). A second factor, "involvement", consists of two items (D5, D4) that refer to the family's willingness to help in the educational tasks of their children, as well as to attending school to talk to teachers, explaining 15.05% of the variance. The third factor refers to "social" aspects and accounts for 11.59% of the variance (items D11 and D12).

Cronbach's alpha for the full scale is .53 (8 items). The alpha for each of the extracted factors is .53 for F1, .47 for F2 and .45 for F3. These alpha values, although lower, are considered sufficient in the early stages of exploratory studies (Nunnally, 1987). Two less consistent items are identified (D11 and D12), whose removal increases the alpha by .6 for 6 items. Nevertheless, we decided to keep them in the study, as their correlations with the rest of the items are significant (p< .001) and they yield factor loadings above .5, both of which are good indicators of construct validity. On the other hand, we want to study how these two items related to a

type of socio-familial characteristic (social aspects) relate to students' attitudes and behaviour in the classroom.

Table 5

Exploratory factor structure of the student attitudes and behaviour in the classroom scale

KMO: .842; Bartlett, χ^2 = 5375.337; gl= 171; P<0.000				
Items	Factor			
	1	2	3	4
B8	.671			
B11	.532			
B2	.519			
B10	.517			
B13	.516			
B16				
B3				
B19				
B20				
B4		.629		
B7		.628		
B5		.540		
B1				
B17				
B12			.816	
B18			.672	
B9				
B14				
B6				.679

For the student attitudes and behaviour in the classroom scale, the factor analysis yielded a total of 4 factors that explain 48.27% of the variance.

Factor 1 consists of items B2, B10, B13, B11, and B8, accounting for 24.40% of the total variance and measuring the value of education as perceived by the student body. Factor 2 is made up of those items that measure acts of disruption in the classroom (B4, B7 and B5) and explain 8.96% of the total variance. Factor 3 explains

7.78% of the variance, saturating items related to having a positive attitude towards education (B12 and B18).

Factor 4 cannot be explained with the underlying dimension property; to be a dimension it must be expressed in several ways, not with a single item.

Regarding Cronbach's alpha, an index of .64 (10 items) was obtained for the full scale. The following indices were found for each of the factors: F1: .75 (5 items), F2: .65 (3 items) and F3: .72 (2 items).

Objective 3. To confirm the influence of socio-familial characteristics on students' attitudes and behaviour in the classroom

The structural equation model depicted in Figure 3 reflects the three types of socio-familial characteristics perceived by students (social, importance of education in the family, family involvement) and their influence on student behaviours in the classroom (disruptive acts, value of education, positive attitude towards education, etc.). In this sense, the model represents the correlations between the three types of perceived socio-familial characteristics and regressions or influences of these on students' attitudes and behaviours in the classroom.

Initially, two models were explored (table 6). Model 1, which considered the relationship of influence between socio-familial characteristics and student attitudes and behaviour in the classroom. Model 2 (Figure 3) improved the fit indices by establishing an influential relationship between the value of education on disruption and the value of education on positive attitude.

Table 6
Goodness-of-fit indices

Model	Chi-square/df	CFI	IFI	NFI	TLI	RMSEA	HOELTER
1	885.62/124 (p>.05)	.85	.85	.83	.79	.07	243
2	777.380/121 (p>.05)	.87	.87	.85	.81	.06	271

Note. df= degrees of freedom

The goodness-of-fit indices indicated that the data fitted the model discretely well. On the other hand, the high rates of variance explained in the factors of disruption (47%), value of education (49%) and positive attitude towards education (20%), as well as the regression and correlation indices, support the conformity of the model (Figure 1).

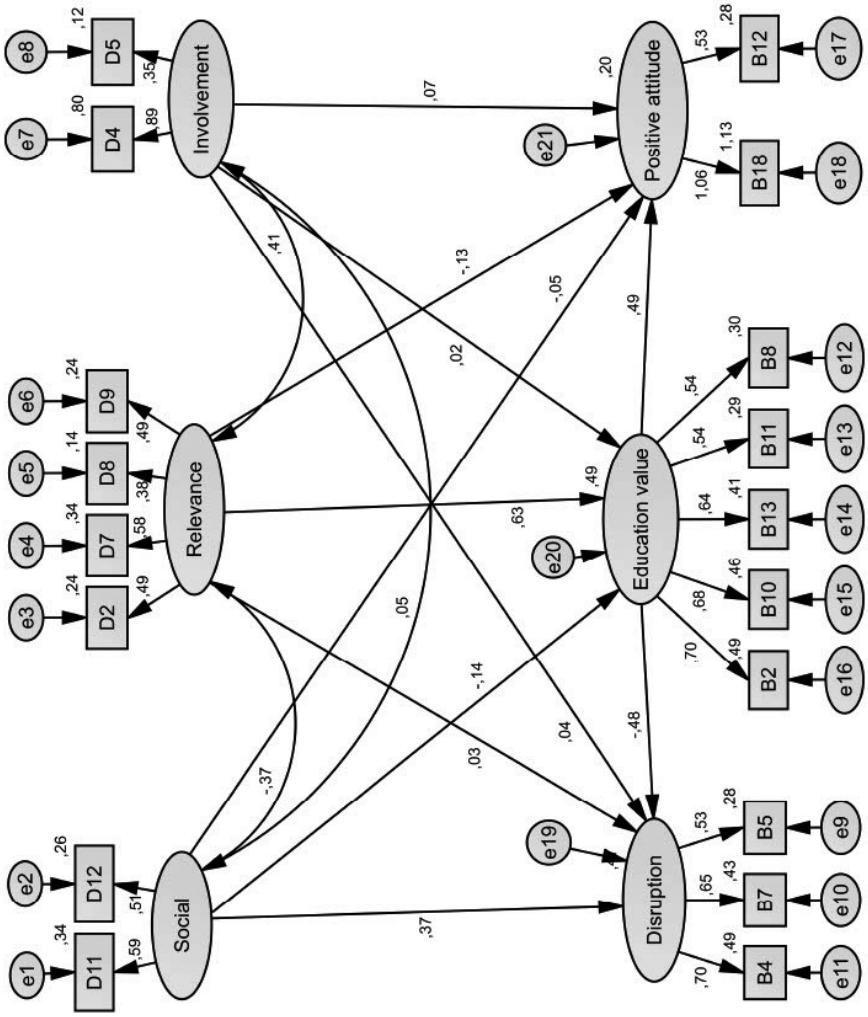


Figure 3
Structural equation model, influence of socio-familial characteristics on students' attitudes and behaviour in the classroom

Table 7 shows the model estimates identifying the relationships explored with standardised and non-standardised values.

Table 7
Model estimates

Relationships Explored			Estimates	
			Standardised	Non-standardised
Value_education	<---	Social	-.140	-.112
Value_education	<---	Importance	.629	.855
Value_education	<---	Engagement	.019	.008
Disruption	<---	Social	.375	.194
Positive_attitude	<---	Social	-.047	-.051
Disruption	<---	Importance	.030	.027
Positive_attitude	<---	Importance	-.133	-.246
Disruption	<---	Engagement	.045	.012
Positive_attitude	<---	Engagement	.073	.042
Disruption	<---	Value_education	-.483	-.314
Positive_attitude	<---	Value_education	.489	.664
D11	<---	Social	.586	1.000
D12	<---	Social	.508	1.005
D2	<---	Importance	.485	1.000
D7	<---	Importance	.580	.922
D8	<---	Importance	.378	1.098
D9	<---	Importance	.491	1.271
D4	<---	Engagement	.894	1.000
D5	<---	Engagement	.350	.372
B5	<---	Disruption	.530	1.000
B7	<---	Disruption	.654	1.192

Relationships Explored			Estimates	
			Standardised	Non-standardised
B4	<---	Disruption	.700	1.460
B8	<---	Value_education	.545	1.000
B11	<---	Value_education	.541	1.360
B13	<---	Value_education	.642	1.183
B10	<---	Value_education	.682	1.375
B2	<---	Value_education	.701	1.358
B12	<---	Positive_attitude	.531	1.000
B18	<---	Positive_attitude	1.061	2.019
Social	<-->	Importance	-.370	-.087
Engagement	<-->	Importance	.415	.182
Engagement	<-->	Social	.049	.037

First of all, in relation to the correlations between the perceived socio-familial characteristics, a high degree of correlation was found between "Importance of education" and "Involvement" ($r = 0.41$, $p < 0.001$). Conversely, between "Importance of education" and "Social characteristics" ($r = -0.37$, $p < 0.001$); and, to a lesser extent, between "Social characteristics" and "Involvement" ($r = 0.15$, $p = 0.262$).

With regard to the regression analysis between factors, the following results can be observed in the model. On the one hand, the perceived importance that the family gives to education has both direct and indirect and significant effects on most of the pupils' attitudes and behaviours in the classroom. Social characteristics are less influential on acts of disruption in the classroom. Family involvement does not have a clear influence on students' attitudes and behaviour in the classroom, and the regression indices are not significant in any of the cases.

On the other hand, the importance given by the family to education as perceived by students seems to exert a direct and significant influence on the "value of education" ($\beta = 0.63$, $p<0.001$). This in turn has a direct and significant influence on the positive attitude of pupils ($\beta = 0.49$, $p<0.001$) and an inverse influence on acts of disruption in the classroom ($\beta = -0.48$, $p<0.001$). In other words, the more importance students perceive the family as placing on education, the more value they place on it, generating positive attitudes towards education and decreasing

disruptive acts in the classroom. With regard to acts of disruption in the classroom, the direct effect of social problems perceived by pupils is confirmed (β= 0.37, p<0.001).

DISCUSSION AND CONCLUSIONS

The main aim of this study was to confirm the influence of socio-family characteristics on the attitudes and behaviour of Andalusian pupils in the classroom as determinants of early school leaving. In this sense, the main results obtained point to the importance of education within the family as the main characteristic. These findings are in line with what is reflected in the studies of Janosz *et al.* (2008), Marchesi (2003), Suberviola (2021) and Vitaro *et al.* (2001), where it is identified that the value given to education by families is a determining factor regarding the risk of dropping out of school, while highlighting the role of the family context as the primary socialisation group (Torío López, 2004). The main socio-familial characteristics include social characteristics, the importance of education in the family environment and family involvement. In this sense, the results of this study, in response to the first objective of this work (to analyse students' perceptions of socio-family characteristics, attitudes and behaviour in the classroom), show that families are concerned about and attach a positive value to studies. That is, their children perceive academic support from their parents, although supervision, monitoring and providing resources and support for their learning (in terms of Reschly & Christenson, 2019) seem not to be perceived by the students.

As for the pupils, a large group values education and disruptive behaviours are rare, which are good indicators of school success; although, on the other hand, the diversity of opinions regarding the fact that they do not like studying or school, a result that coincides with other research in the same context (González-Losada, *et al.*, 2015), means that we should keep an eye on these risk factors. Although there is a correlation between inappropriate behaviour and the risk of students dropping out of school, this study shows, as mentioned, a very low proportion of disruptive behaviour or misbehaviour in the classroom: expulsion [81.4%], being a nuisance [1.4%], arriving late to class [5.4%], according to the students' perception of the risk of dropping out of school. This may be due to the protective factor of families.

As for the second objective, to assess the construct validity of the "socio-familial characteristics" and "pupils' attitudes and behaviour in the classroom" scales, the factorial structure was corroborated, with 3 factors (the importance that the family attaches to the education of their children, the family's involvement in helping their children and attendance at the school to talk to teachers and social aspects) in the "socio-familial characteristics" scale. On the scale of pupils' attitudes and behaviour in the classroom, the factor analysis projected 3 factors: value of education as

perceived by students; disruptive acts in the classroom; and having a positive attitude towards education.

With reference to the third objective, to confirm the influence of socio-familial characteristics on students' attitudes and behaviour in the classroom, we highlight the evidence that socio-familial characteristics do influence their attitudes and behaviour in the classroom, both directly and indirectly. Directly, because social problems (such as poor relationships between young people and wanting to drop out of school) predict acts of disruption in the classroom. In agreement with Torío López (2004) and Suberviola (2021), the importance that the family attaches to education predicts that students will give value to education. And indirectly, because the value of education, predisposed by the importance given to it by the family, has a moderating effect on acts of disruption. In other words, the more value students place on education, the less disruptive acts seem to occur in the classroom. The value of education also has a moderating effect on positive student attitudes.

The model outlines the proximity of the three socio-familial characteristics through the strength and significance of the correlation. Thus, there is a gradual increase in the distance between the different characteristics, in such a way that the importance that the family attaches to education is closer to family involvement, and family involvement, at the same time, is further away from social problems, and in the same sense, the importance that the family attaches to education is closer to the absence of social problems.

Therefore, a certain arrangement is shown between the different socio-family characteristics that show a close nature to each other. On the one hand, involvement seems to be associated with importance and, on the other hand, an increase in importance seems to decrease social issues. In this sense, involvement, in the equation, does not appear as a predictor of students' attitudes and behaviour in the classroom, but it does appear to be associated with importance.

As limitations, we first highlight some of the model's fit values (CFI=.87; IFI=.87; NFI= .85; TLI= .81) that are below the minimum and therefore susceptible to improvement. However, these indices are measured in a range of 0-1 and are considered acceptable values when they are close to or above .9, being those that show the best fit of the model. In our case, although we are at the limits of the recommended values, we think it is important to propose an explanatory model that serves, albeit in an exploratory way, to gain a more precise understanding of the phenomenon in question.

We want to understand the model beyond the isolated interpretation of fit indices, as it allows us to examine the established relationships, which, although they do not achieve a good fit, do present initial acceptance values within the established limits, and also fit the theoretical foundations reviewed.

In second place, another limitation is based on the need to contrast the students' opinions with those of the teachers and families, in order to help us to adjust the objectives set. On the other hand, the use of the questionnaire provides us with quantitative results, so it would be interesting to consider new research with other qualitative instruments to complement and triangulate the results, as proposed in studies such as those by Janosz *et al.* (2000) or González-Losada *et al.* (2015), among others. In addition, we must remember the bias of the students' answers due to "social desirability", and that the sample selection was intentional (defined by the educational authorities of the Andalusian community). Both issues have conditioned the results and will be taken into account in future research.

Finally, in line with the contributions of Hernández Prados and Alcaraz Rodríguez (2018), Janosz (1997) and Suberviola (2021), the present study has allowed us to gain more in-depth knowledge of the risk factors for school dropout related to socio-family characteristics, student attitudes and behaviours in the classroom, and pupils' behaviour in the classroom. Along these lines, we propose that schools should tackle school dropout from the earliest educational stages and take care of transitions between educational stages in order to guarantee the commitment of all students to their studies (Fredricks *et al.*, 2019). These interventions can be approached from various perspectives: on the one hand, they should promote the design and development of educational projects of a preventive nature that focus on furthering specific content related to personal development (self-esteem, self-knowledge, self-concept, self-control, social skills, life skills, resilience, decision-making, etc. and teaching-learning strategies (intellectual work techniques, motivation, learning to learn, active learning methodologies, etc.). These actions should be reflected in the guidance, action and tutorial plans of educational centres, in which families should be involved so that the proposals are developed in a coordinated manner within and outside the educational context.

Socioeconomic characteristics in Andalusia are complex and have consequences on students' engagement, motivation and academic improvement. This is a variable that is difficult to tackle. However, in order to alleviate these realities, it is necessary that schools, together with families, define and combine ways to work on positive expectations and support the educational process both academically and motivationally. Family influence, which plays an important role in school success, has been studied and counteracts the bad influences of peers (Reschly & Christenson, 2019). In this sense, teachers should receive training to improve these strategies for working with families, as they have difficulties and gaps in this area of intervention (Epstein & Sanders, 2006).

Another fundamental line of work to be developed should focus on the demotivation and low commitment of students. In this sense, in the Andalusian community we find different programmes and actions. Among them, the so-called

Performance and Learning Improvement Programmes (PMAR) approved in the Organic Law for the Improvement of Educational Quality, although Márquez and Indarramendi (2022) note that these programmes are having little effect as a strategy to prevent school failure. And the Second Chance Schools, "... an educational resource that has adopted flexible organisational structures and proactive procedures, based on individualised attention, dialogue and the involvement of agents from outside the school itself" (Prieto, 2015, p.110).

In short, we agree with Bayón-Calvo (2019) that Spain, and especially Andalusia, has a high rate of early school dropout that needs to be reduced. Also, it is necessary to continue to analyse in depth the factors that affect it and the evaluation of the programmes that are implemented to prevent it. Along with this, it is important to emphasise the complexity of the problem, given the multiple factors involved and the need to mobilise global education policies in order to provide more comprehensive responses to this troubling situation.

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ANNEX I. SOCIO-FAMILIAL CHARACTERISTICS SCALE

Items
D1. I have enough time to study
D2. My family is concerned about my grades
D3. Someone in my family has a major drug or delinquency problem
D4. My family goes to the school to talk to the teachers
D5. My family helps me with my homework assignments
D6. My family gets angry when I skip class
D7. My family thinks that studying is very important
D8. My family speaks well of the teachers and the school
D9. My family is confident in my ability to succeed in my studies
D10. My family ask me to help them in their work
D11. In my neighbourhood there are bad relations between young people
D12. Many of my friends are thinking about giving up studying

ANNEX II PUPILS' ATTITUDES AND BEHAVIOUR IN THE CLASSROOM SCALE

Items
B1. I come late to class
B2. I pay attention in class
B3. In class I feel nervous, tense and stressed
B4. I deliberately disturb the class by behaving incorrectly towards the teacher
B5. I pester my classmates
B6. My classmates annoy me
B7. They throw me out of the class
B8. I get on well with my colleagues
B9. I get on well with my teachers
B10. I think studying is a waste of time
B11. I think I'm just another pupil, with the same options to pass as my colleagues
B12. I like studying
B13. I think getting good grades is very important
B14. I feel good about myself
B15. I feel able to influence others
B16. I feel isolated
B17. I usually skip classes without justification
B18. I like the school
B19. Teachers encourage me to study and appreciate the effort I make
B20. My teachers think my class is one of the worst

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The digital gender gap in secondary school: differences in self-perceived competence and attitude towards technology

Brecha digital de género en secundaria: diferencias en competencia autopercibida y actitud hacia la tecnología

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ABSTRACT

The digital gender gap, defined as the difference between men and women in the use and exploitation of digital technologies (DTs), translates into an unfavorable social and economic scenario for women. Responding to this reality means exploring the development of Digital Competence (DC) and the attitude towards the use of DTs, to offer training that truly reduces possible differences between genders. This article investigates gender differences, both in self-perceived DC, and in the attitude towards the use of DTs throughout secondary education in Spain. The research is quantitative, with a survey design. The sample is made up of 3249 boys and girls, students in the 2nd and 4th year of ESO and the 2nd year of upper secondary school. The Digitalis-ESO questionnaire measures self-perceived DC (α=.908),

attitude (α=.914), and other demographic data. A descriptive analysis of frequencies, a comparative and correlational study, using chi-squared, t-tests and Pearson correlations, is performed. Boys report higher levels of DC perception and attitude than girls, with medium effect sizes. Furthermore, DC improves with the course for both genders, while attitude worsens significantly for girls. The detail of the DC items indicates that girls perceive themselves as more skilled in academic and communication-related activities, while boys believe they excel in technical activities. Finally, the analysis of attitude towards the use of DTs shows a strong incidence on the self-perception of DC, both for boys and girls. These results confirm the existence of a digital gap in favor of boys, thus training and support actions are necessary for girls, especially in technical aspects of DC, which also help them improve their attitude towards the use of DTs.

Keywords: digital competence, secondary school students, attitude, gender, self-perception

RESUMEN

La brecha digital de género, entendida como la diferencia entre hombres y mujeres en el uso y aprovechamiento de las tecnologías digitales (TD), se traduce en un escenario social y económico desfavorable para las mujeres. Responder a esta realidad supone explorar el desarrollo de la Competencia Digital (CD) y la actitud hacia las TD, para ofrecer una formación que verdaderamente reduzca las diferencias de género. Este artículo indaga sobre las posibles diferencias entre chicos y chicas, tanto en CD autopercibida como en actitud, a lo largo de la educación secundaria en España. La investigación es de corte cuantitativo, con diseño de encuesta. La muestra está compuesta por 3249 chicos y chicas, estudiantes de 2º y 4º de la ESO y 2º de Bachillerato. El cuestionario Digitalis-ESO mide la CD autopercibida (α=.908), la actitud (α=.914), y otros datos demográficos. Se realiza un análisis descriptivo de frecuencias, un estudio comparativo y correlacional, mediante Chi-cuadrado, pruebas t y correlaciones de Pearson. Los resultados señalan que los chicos poseen niveles de percepción de la CD y actitud superiores a las chicas, con tamaños de efecto medios. La CD, además, mejora con el curso para ambos géneros mientras que, la actitud empeora significativamente para las chicas. El detalle de los ítems de la CD indica que las chicas se perciben como más hábiles en actividades académicas y comunicativas, mientras los chicos creen destacar en actividades técnicas. Finalmente, la actitud muestra una fuerte incidencia sobre la autopercepción de la CD, tanto para chicos como para chicas. Esto confirma la existencia de una brecha a favor de los chicos, por lo que son necesarias acciones formativas y de acompañamiento para chicas, sobre todo en los aspectos técnicos de la CD, y que también les ayuden a mejorar su actitud hacia las TD.

Palabras clave: competencia digital, estudiante de secundaria, actitud, género, autopercepción

INTRODUCTION

Digital competence (DC) education for students is now regarded as a fundamental requirement for their engagement in society (European Commission, 2006). Students are making increasing use of digital technologies (DTs), prompting the need for an educational strategy that emphasizes the efficient, secure, critical, and responsible use of those tools in order to ensure the development of digital competence (Santana-Vega et al., 2019). To meet societal and, consequently, educational needs, the discussion must center on how to teach digital citizenship at the different stages of compulsory education.

Enormous efforts are being made to improve DC levels in teachers and students alike. However, providing this type of competence poses new challenges for schools because of the rapid pace at which digital technologies are evolving and the difficulties presented by the changing needs of our modern multimedia society (Jacobs, 2014). Reports such as that recently published by the statistical office of the European Union (Eurostat, 2020) continue to present evidence that, despite all the efforts being made, many members of the general public, especially women, still have only a basic level of DC. The COVID19 pandemic further demonstrated this low level of DC development, not only among the general population, but among students and teachers as well (Zhang et al., 2020). Therefore, teaching and learning strategies must include ways to improve DC, and these approaches must be based on an analysis of how DC develops during the various educational stages, along with the factors that may have an influence on that development.

It is also important to acknowledge the presence of a digital gender gap, which exists not only in relation to the use of technologies, but also in terms of more complex digital skills, such as programming and computational thinking (Mateos-Sillero & Gómez-Hernández, 2019). Although after reviewing a variety of studies on this subject, Wang and Degol (2017) concluded that there are no differences in cognitive aspects. They emphasized three factors that are responsible for the gender gap: occupational interests or preferences, including lifestyle values or work-family balance preferences; gender-related stereotypes and biases; and field-specific ability beliefs, in this case those related to technology.

The existence of this digital gap has significant consequences for the DC levels achieved by students. It puts limits on their full development even under conditions of equality, especially in terms of their need to make progress in the context of a digital culture in a way that will facilitate their incorporation into society and the workplace. Gender-based differences also affect a country's economic development because this type of inequality leads to a scarcity of women in industries such as engineering and electronics (Mateos-Sillero & Gómez-Hernández, 2019).

Although the phenomenon known as the digital gender gap has been widely reported outside of the academic environment, the topic has very seldom been addressed in the scientific literature specifically in relation to education. The few studies that do exist suggest that secondary school is a key stage for the development of DC in students and is therefore also a phase in which the digital gender gap may broaden, as students are more heavily influenced by gender-based roles and stereotypes than during their primary education (Dasgupta & Stout, 2014; Niño-Cortés et al., 2022). Another essential factor that affects the development of DC in students is the attitude they have towards DTs (Fernández-Miravete, 2018), and gender can also have an influence on how those attitudes evolve for students during secondary school (Jan, 2017). However, very few studies can be used to identify needs and assist with designing specific curricula that can actually help decrease these inequalities and therefore contribute to improving the development of DC in all students. This context has given rise to a need for new research on how gender may be affecting the development of DC in students throughout their years in secondary school and on the relationship between that development and their attitude towards DTs. Such research would serve to help close the digital gap for women in terms of digital competence and attitude.

What does digital competence mean and how do students develop it?

Given the complexity of the current context, no unanimous consensus has been reached regarding how the term 'digital competence' should be used and conceptualized (Sánchez-Caballé et al., 2019). However, during the last two decades, a variety of frameworks have been defined regarding the variables that contribute to a student's level of DC. Some of the most notable of these include the standards developed by the International Society for Technology in Education (ISTE, 2016), DigEuLit (Martin, 2006), DigComp (Vuorikari et al., 2016), and specifically in Spain, the framework presented by Larraz (2013). In this article, we use the definition of DC proposed by Larraz, who defines a student's DC in terms of four types of digital literacy (information, technology, multimedia, and communications), and who maintains that an overall understanding of this phenomenon can only be achieved by considering the interactions among all four of these types (2013).

The DC performance testing reported in previous studies suggests that secondary school students demonstrate a basic DC level that is still "far below what is expected" (Fernández-Abuín, 2016, p. 95). However, measuring DC is a complex task because of its nature as a multidimensional construct that is also affected by the rapid changes taking place in the technological environment (González-Rodríguez & Urbina-Ramírez, 2020). For this reason, several studies have focused solely on

understanding self-perceived DC as reported by students (Jin et al., 2020; Siddiq & Scherer, 2019).

All of this creates a need for research that can analyze digital competence through a single evaluation framework, to produce the essential information needed for detailed study and characterization of the digital gender gap and its evolution during secondary school.

The influence of gender on the development of DC

In recent decades, gender has received special attention as one of the factors that affects the development of digital competence in students (Cai et al., 2017). Studies on gender differences in actual DC performance in primary and secondary school have often reported slightly better performance in girls than boys (Cussó-Calabuig et al., 2018), and Siddiq and Scherer (2019) found that this pattern was already present in primary school. Although the majority of studies of this type have found similar results, other authors, such as Calvani et al. (2021), have reported better DC results in boys than in girls.

Other researchers have reported varied gender-based differences in DC levels, but also found an increase in differences in secondary school students compared to primary school students. For example, Jin et al. (2020) found not only that older students generally show better DC results, but also that significant gender-based differences appear during secondary education. However, those results have also been contradicted. In their metaanalysis on the use of DTs, Siddiq and Scherer (2019) concluded that the largest gender-based differences in DC levels were seen during primary education rather than secondary.

In other studies, researchers have found that gender-based differences are more significant when measured as self-perceived assessments of DC, rather than through actual performance testing. Secondary school boys report higher DC self-perception scores than girls do (Calvani et al., 2012), as they tend to consider themselves as more highly skilled in the use of DTs. Other authors, such as Aesaert and van Braak (2014), have concluded that those differences in self-perception are especially notable when assessed in relation to specific competence indicators. For example, researchers have reported that boys have a higher self-perception than girls do in relation to searching for, selecting, and organizing information (Amor & Serrano, 2019) and in relation to aspects that are more technical (Bunz et al., 2007). On the other hand, girls perceive themselves as being more capable in relation to using DTs for creative purposes, for communication, and for establishing social relationships (Amor & Serrano, 2019; Martínez-Piñeiro et al., 2019). Studies like these provide evidence of a digital gender gap not only in the development of DC, but also in selfperceptions of DC and the various types of digital literacy it includes.

In summary, the results discussed above suggest that gender-based differences are diverse, and that they may be influenced by variables such as context, the measurement tools being used, and other limitations of the studies performed. However, these differences tend to be higher in terms of DC selfperception than actual performance, especially if the students' age is considered along with the ongoing influence of gender stereotypes (Dasgupta & Stout, 2014). In addition, as mentioned above, selfperception is one of the reasons why the gender gap exists, along with interests, preferences, and lifestyle values (Wang & Degol, 2017). However, despite this evidence, there is no research available regarding how selfperceived DC evolves based on gender. This gives rise to the need for more specific studies on how the digital gender gap emerges among secondary school students in Spain.

The influence of attitude towards DTs on the development of DC.

Attitude towards DTs is another relevant factor related to the digital gender gap. Some studies have revealed a direct relationship between that attitude and DC levels (Fernández-Miravete, 2018). Some research suggests that although students tend to report a positive attitude towards technology, their actual performance levels are not always as positive (Martínez-Piñeiro et al., 2019; Porat et al., 2018). Authors such as González-Martínez et al. (2018) and Jan (2017) have shown a correlation between a positive student attitude towards DTs and higher levels of DC development. In view of this close relationship, researchers often measure not only DC levels in students, but also their opinions, attitude, and beliefs about DTs (González-Martínez et al., 2018; Hatlevik et al., 2015).

However, the relationship between gender and attitude towards DTs remains controversial, with a lack of conclusive evidence. Some studies have found no gender-based differences in terms of attitude towards DTs, while others have found evidence that boys have a more positive attitude towards DTs than girls do (Cussó-Calabuig et al., 2018). On the other hand, a study conducted by Gargallo et al. (2016) found that in secondary school contexts, boys seemed to demonstrate more competence in their use of DTs, while girls demonstrated more a positive attitude towards them.

In conclusion, there is a lack of clear evidence that could lead to a better understanding of the relationships between these variables or the influence they might have on decreasing the digital gender gap. This scarcity of evidence underscores the need for further research on this subject, with attitude treated as a relevant factor.

Research questions

Despite the fact that, when assessed by performance tests, girls perform slightly better than boys, when asked about their competence, girls perceive themselves as less competent than boys (Martínez-Piñeiro, 2019; Cai et al., 2017). As discussed above, a more negative attitude towards DTs could be related to girls' lower self-perception of their level of DC. Other factors must also be considered, such as the students' particular year in school or age because although DC should improve with each year of classwork, as students get older, they may also be more strongly influenced by gender-based roles and stereotypes with regard to DTs. However, the information available for Spain is only partial because, to date, no studies focusing on secondary education have included a quantitative, overall analysis of the influence of these factors on self-perceptions of DC and its various aspects.

The aim of the research being reported here was to study potential inequalities in the way that DC develops among secondary school students based on their gender, year in school, and attitude towards DTs, in order to address the following research questions:

- Question 1 (Q1). What gender-based differences can be identified in secondary school students in Spain in terms of their levels of DC self-perception and their attitude towards DTs?
- Question 2 (Q2). What relationships among secondary school year, DC self-perception, and attitude towards DTs can be identified among students in Spain based on their gender?

METHODS

This research aimed, firstly, to describe the levels of self-perceived DC and attitude towards DTs among students in the various years of secondary school and, secondly, to measure any potential differences between boys and girls. We have therefore taken a quantitative approach using a survey-based research design. The objective was to study the opinions and characteristics of a large number of students (Creswell & Guettermann, 2013), while at the same time enabling us to determine and measure possible correlations among the variables.

Sampling

To address the research questions, non-probability convenience sampling was used to collect survey responses from voluntary respondents, who were students

from the Spanish regions of Catalonia, the Valencian Community, Extremadura, the Community of Madrid, Andalusia, Aragon, Cantabria, and Murcia. As shown in Table 1, a total of 3363 responses were obtained from students between 13 and 18 years of age in the 2nd year of ESO, 4th year of ESO, and 2nd year of upper secondary school.[1] It is important to point out that 46 of those students identified as gender nonbinary and 68 preferred not to respond to the question on gender (DK/NR), so the total sample used in the study consisted of 3249 boys and girls.

Table 1
Distribution of the study sample by gender and grade level

Gender	2nd ESO	4th ESO	2nd upper secondary	Total
Girls	732	707	229	1668
Boys	756	645	180	1581
Sample	1488	1352	409	3249

Note. The numbers express the number of students in each category and for each course.

Of all the participants in the study, 50% identified as female, 47% identified as male, 1% percent identified as gender nonbinary, and 2% preferred not to give a response. A chisquared test showed that the distribution of genders for the respondents from the 2nd year of ESO is representative of Spain's entire population between 10 and 14 years old (49% female and 51% male): ($\chi^2_{1,\ n=1488}$ = .000, p = 1.000), and that the distribution of genders for the respondents from the 4th year of ESO and 2nd year of upper secondary is representative of Spain's entire population between 15 and 19 years old (48% female and 52% male): ($\chi^2_{1,\ n=1761}$ = .002, p = .317).

Tools and procedures

The survey tool used in this study to measure the students' self-perceived DC levels was DigitalisESO, which is an updated version of the INCOTICESO survey tool (González-Martínez et al., 2012). The tool has been used in numerous studies (Abou & Martínez, 2017; Fernández-Miravete, 2018) after being designed, tested,

[1] 'ESO' refers to the four required years of secondary school in Spain (*Educación Secundaria Obligatoria*), and 'upper secondary' refers here to the optional *Bachillerato*, which is an additional 2year advanced secondary school phase.

and validated for use with secondary school students in Spain. It was created as an adaptation of the INCOTIC survey tool (Gisbert et al., 2011), which was originally designed and validated for use with university students for DC selfassessment and other aspects related to DTs based on the definition of DC published by Larraz (2013).

Although there is a version of INCOTIC updated by González-Martínez et al. (2018), INCOTICESO had not been modified since 2012. For this reason, DigitalisESO was created in late 2019 by updating the wording of items from that INCOTICESO survey tool, which was necessary because of the emergence of new digital technologies. That qualitative work was performed by a group of five teaching and research experts from the field of educational technology. In early 2020, the new DigitalisESO was used in a pilot study with 344 secondary school students, with a final version then produced by modifying the wording of certain items. Its factor structure and reliability were then studied using the responses of 3363 secondary school students. A principal components analysis (PCA) indicated a good sampling adequacy using the Kaiser-Meyer-Olkin test (KMO = .928, p = .000), and a twofactor structure was determined (see Appendix 1), explaining 63% of the total variance. Those two factors correspond to the variables DC and attitude towards DTs. Finally, Cronbach's alpha was calculated for the sample used in this study, for the entire survey tool and for each factor, and the results were similar to those obtained with other versions of INCOTIC, indicating good internal consistency (α_{DC}=.845; α_{Att}=.832; α=.882).

The Digitalis-ESO survey consists of two sections. The first section measures aspects related to use of DTs and access to them (these aspects were not included in the present study), and it also includes 19 items used to measure DC self-perception and 9 items on attitude towards DTs. A 5point Likert scale is used for all these responses (1: I don't know how to do it; 5: I know how to do it perfectly) (see Appendix 1). Based on those responses, and following the recommendations of González-Martínez et al. (2012), the scores obtained for the male and female participants were categorized into three development levels for self-perceived DC: low ($1 \leq x < 3.2$), medium ($3.2 \leq x < 3.8$), and high ($3.8 \leq x \leq 5$), and three categories were also created for attitude towards DTs: low ($1 \leq x < 3.6$), medium ($3.6 \leq x < 4.2$), and high ($4.2 \leq x \leq 5$).

The survey tool's second section collects socio-demographic data. Specifically, and in accordance with the focus of this research, the students were asked about their primary gender identity: girl, boy, neither response (gender nonbinary), or don't know / no response (DK/NR). As mentioned in the previous section, in order to facilitate the statistical analyses, and for consistency with existing studies that have only made use of binary gender options (male or female), only the responses from students answering either boy or girl were included in the present study. The students were also asked to give their age, secondary school year, and whether they

had repeated any years (and if so, which one). Finally, the students were asked to indicate the Spanish region and municipality where their school is located.

Data were collected through a public opinion research firm, which directly contacted several secondary schools via their published addresses as well as regional education services in the Spanish regions included in the study. The participating students obtained an automated response by email, which provided feedback on the responses they gave for their DC levels and attitude. The questionnaire was administered during the last quarter of the 2020-2021 academic year and the first quarter of the 2021-2022 academic year. Both the survey tool (implemented using the Alchemer survey platform) and the data collected were stored on the university's server. The data were anonymized and adapted to spreadsheet format to create the pertinent database. Sample selection, survey tool creation and administration, and data processing took place in strict compliance with ethical principles on anonymity and consent for data disclosure established by the British Educational Research Association. These procedures were also approved by the university's research ethics committee (Ref. CEIPSA-2021-PR-0046).

Analysis

To address the research questions, a descriptive analysis was first conducted on the overall data on DC self-perception, with indicators for DC, secondary school year, and gender. Next, attitude towards DTs was analyzed, also in terms of students' secondary school year and gender. The distributions of the resulting level categories were then examined using the chisquared (χ^2) test with a significance level of p=.05 because of the ordinal (DC and attitude) and nominal (gender) nature of the variables. A ttest with the same significance level was then used to measure potential differences between the mean scores for boys and girls, with effect size also determined (Cohen's D). Finally, to assess the relationship between self-perceived DC and attitude towards DTs, for the boys and for the girls, a nonparametric measure of rank correlation was performed using Spearman's rho, which is suitable for ordinal data (Creswell & Guettermann, 2013). The software used to analyze the data was IBM SPSS Statistics for Windows, version 28.0.

RESULTS

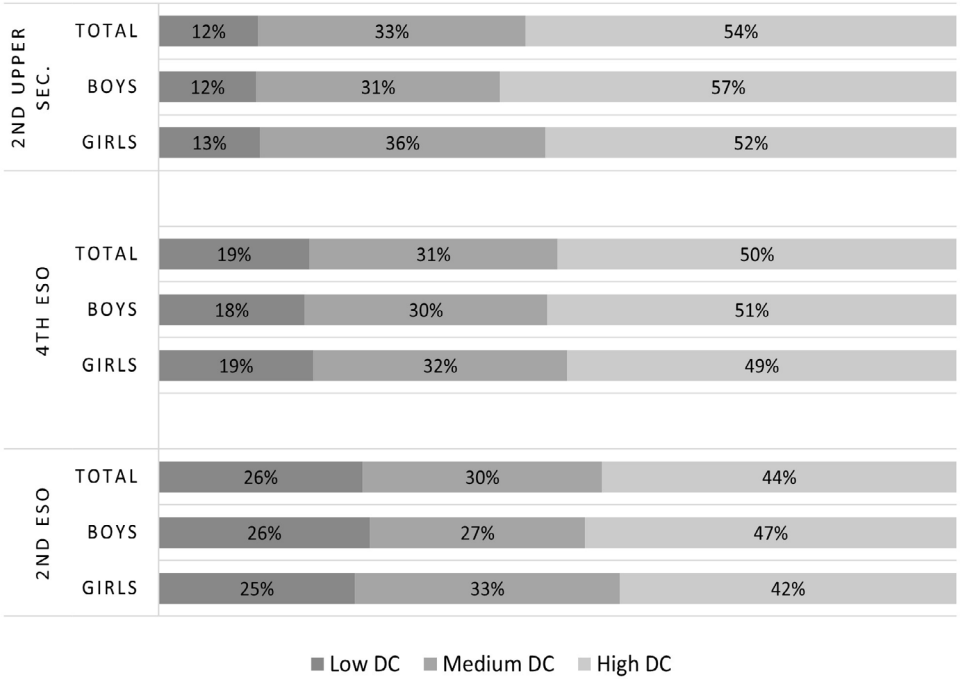
Gender-based differences among secondary school students in self-perceived DC and attitude towards DTs (Q1)

Figure 1 shows the values obtained for self-perceived DC for each of the three secondary school years included in the study, classified by level (low, medium, and

high) and broken down by gender. In general, the students from all the school years studied consider themselves digitally competent.

Figure 1

Self-perceived digital competence levels by gender and secondary school year.



Note. Results show the proportion of students in each DC level (low, medium, and high). Source: authors.

The data on gender-based differences in DC self-perception show that over the course of their secondary school years, a higher proportion of boys report a high level of DC compared to girls. In contrast, girls are more likely to report a medium DC level for all of the secondary school years examined.

A more detailed comparative analysis of the mean scores by gender (Table 2), using a ttest, shows that for both boys and girls, self-perceived DC improves as the students advance through secondary school, although the mean score for girls is always a few tenths of a point lower. These differences were found to be statistically significant (p=.039) in the 2nd year upper secondary students, which is also confirmed by the effect size (Cohen's D), which is close to the value of 0.8.

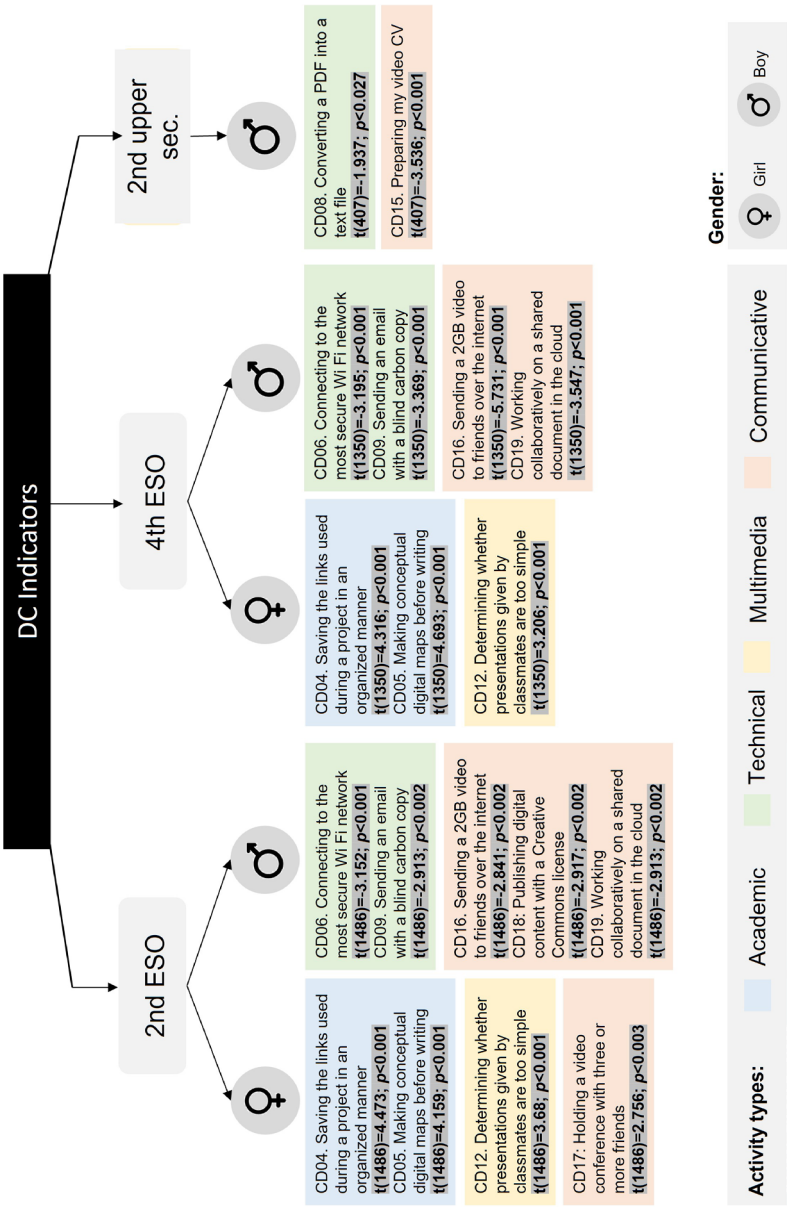
Table 2
Results of the gender-based DC analysis for each secondary school year studied

DC	Girls		Boys		t	p	Cohen's D
	M	DT	M	DT			
2nd ESO	3.63	0.595	3.64	0.682	-0.374	.354	0.636
4th ESO	3.71	0.619	3.75	0.619	-1.181	.119	-0.619
2nd upper sec.	3.80	0.535	3.90	0.573	-1.769	.039*	-0.552

Note. M: mean; SD: standard deviation; *p<.05.

We were also able to perform a detailed analysis of gender-based differences in the students' DC self-perception for each of the indicators that were used to measure that competence. In total, for the three years in school studied, significant differences were found in 12 of the 19 indicators, with p<.05 (see Appendix 1). Additionally, seven indicators presented significant differences in the 2nd year of ESO and 4th year of ESO groups: DC04, DC05, DC06, DC09, DC12, DC16, and DC19 (Figure 2). Specifically, girls in both of those secondary school years perceive themselves as more competent than boys do in relation to performing certain academic activities: (a) saving the links used during a project in an organized manner (DC04) and (b) making digital concept maps before writing (DC05); and multimedia activities: (c) determining whether presentations given by classmates are too simple (DC12). In contrast, boys in both of those school years perceive themselves as more competent than girls in relation to certain technical activities: (a) connecting to the most secure WiFi network (DC06) and (b) sending an email with a blind carbon copy (Bcc) recipient; and in a higher number of communication activities: (c) sending a 2GB video to friends over the internet (DC16) and (d) working collaboratively on a document (DC19). For these types of activities, gender-based differences in perceptions persist in the secondary school years studied, although for the 2nd year of upper secondary group statistically significant differences were only found in two indicators.

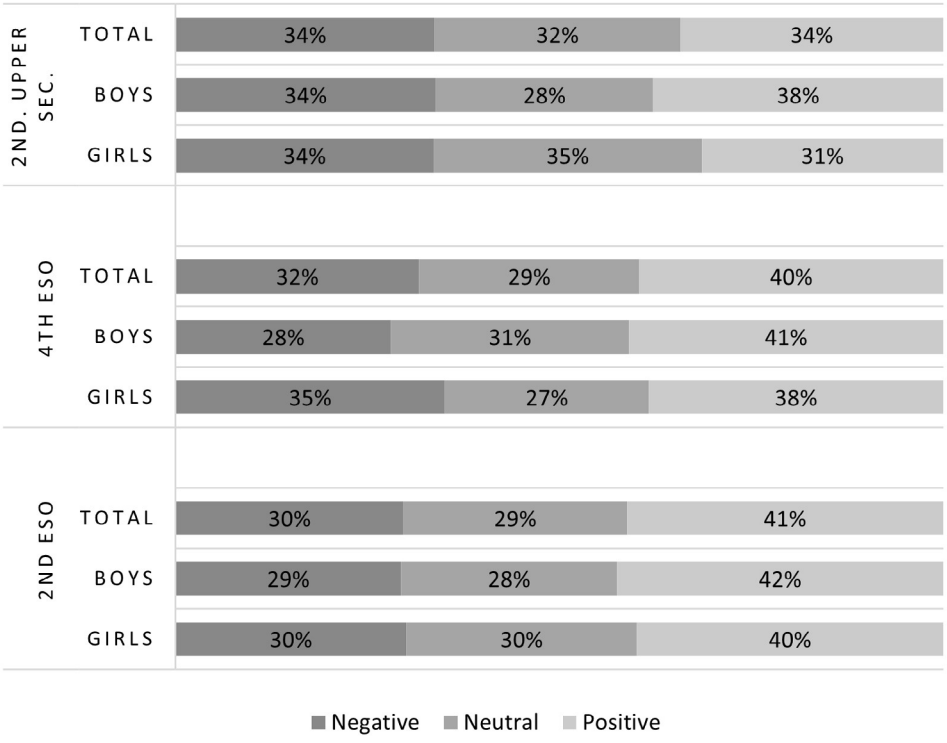
Figure 2
DC indicators with the highest mean scores by secondary school year, gender, and activity type



Note. The gender symbols indicate the group of students perceiving themselves as significantly more competent for the indicator described.

The same types of analysis were performed in order to study potential gender-based differences in attitude towards DTs. Figure 3 shows the proportion of students, broken down by gender and secondary school year, who have a more positive, neutral, or negative attitude towards DTs. In general, most students reported a positive attitude, although in similar proportions to the numbers of students who said they had a more neutral attitude, especially in the 2nd year of upper secondary school. Table 3 shows the data on the mean scores for attitude, broken down by gender.

Figure 3
Attitude towards DTs by gender and secondary school year



Note. Results shown as percentages of students responding in each attitude category (negative, neutral, and positive).

We also found differences between the attitude of boys and girls, both in terms of the proportions of students identifying themselves as belonging in each of the categories and the mean scores calculated. The proportion of boys with a positive

attitude towards DTs was higher than that of girls, all the way from the 2nd year of ESO through the 2nd year of upper secondary school. However, these gender-based differences were only statistically significant for students in the 4th year of ESO ($\chi^2_{2, n=1352}$ = 8.10, p=.017), not for the 2nd year of ESO or 2nd year of upper secondary students. Therefore, only in the 4th year of ESO was the proportion of boys reporting a positive (41%) or neutral (31%) attitude towards DTs significantly higher than for girls. A comparison of the mean scores confirms these results (Table 3): the difference between genders is only significant in terms of mean values for students in the 4th year of ESO (p=.037). And, again, the effect size is close to 0.8, which is considered sufficiently significant for the sample studied.

Table 3
Results of the gender-based analysis of students' attitude towards DTs

Attitude	Girls		Boys		t	p	Cohen's D
	M	DT	M	DT			
2nd ESO	3.94	0.673	3.94	0.734	-0.111	-.456	0.709
4th ESO	3.86	0.739	3.93	0.728	-1.179	.037*	-0.733
2nd upper sec.	3.82	-0.732	3.87	0.749	-0.633	.263	-0.741

Note. M: mean; SD: standard deviation; *p<.05.

Changes over time in secondary students' self-perceived DC levels and attitude towards DTs, and correlation between those two variables (Q2)

With regard to self-perceived DC, the highest proportions of students in all of the secondary school years studied perceived themselves as having a high level of DC: 2nd ESO (44%); 4th ESO (50%); and 2nd upper secondary (54%). These results show a statistically significant upward trend over time in the overall level of self-perceived DC ($\chi^2_{2, n=3249}$ = 40.99; p=.000). In other words, as the students advance through their secondary school years, they see themselves as having increasing levels of DC. This trend was found to be significant in relation to both girls ($\chi^2_{4, n=1668}$ = 18.86; p=.001) and boys ($\chi^2_{4, n=1581}$ = 24.43; p=.000).

Differences over time were also detected in attitude towards DTs. The highest proportions of students reporting a positive attitude towards DTs were those in the 2nd year of ESO (41%) and the 4th year of ESO (40%), while students in the 2nd year of upper secondary school exhibited a lower percentage of a positive attitude (34%). In other words, attitude towards DTs get worse as students advance through

their secondary school years. This downward trend was statistically significant for girls ($\chi^2_{4,\ n=1668} = 10.544$, p=.032), but not for boys ($\chi^2_{4,\ n=1581} = 3.460$, p=.484).

The results described above were confirmed by the correlation analysis (Table 4). Self-perceived DC improved significantly over time for both girls and boys, in a very similar manner. On the other hand, attitude towards DTs worsened significantly only for girls. Although the data for boys also showed a downward trend, it was not statistically significant.

Finally, the correlation analysis also showed a positive and statistically significant relationship between attitude and self-perceived DC level (Table 4): students who reported higher levels of self-perceived DC also reported a more positive attitude towards DTs. This correlation was observed for both girls and boys, although the correlation coefficient was slightly higher for the boys.

Table 4

Spearman's correlation coefficient. Secondary school years, DC levels, and attitude towards DTs by gender

Gender	Variable		Year	DC	Attitude
Boys	Year	Correlation coeff.	1	.124**	-.032
		Sig. (2-tailed)		.000	.163
	DC	Correlation coeff.	.124**	1	.501**
		Sig. (2-tailed)	.000		.000
	Attitude	Correlation coeff.	-.032	.501**	1
		Sig. (2-tailed)	.163	.000	
Girls	Year	Correlation coeff.	1	.119**	-.069**
		Sig. (2-tailed)		.000	.003
	DC	Correlation coeff.	.119**	1	.453**
		Sig. (2-tailed)	.000		.000
	Attitude	Correlation coeff.	-.069**	.453**	1
		Sig. (2-tailed)	,003	,000	

Note. (*) Correlation is significant at the .05 level; (**) Correlation is significant at the .01 level.

DISCUSSION AND CONCLUSIONS

The purpose of this research was to analyze gender-based differences over the course of secondary school education in relation to the students' self-perception of DC, both in general and for each of the specific DC indicators studied. An additional aim was to detect any possible correlations among the variables secondary school year, self-perceived DC level, and attitude towards DTs, and to compare the results obtained for girls and boys.

We found that the secondary school students surveyed generally perceived themselves as being digitally competent. However, when those DC self-perception levels were analyzed in further detail and in relation to the other individual variables examined in this study (gender, secondary school year, and attitude towards DTs), significant differences emerged. These differences can contribute to better understanding specific aspects of the digital gender gap in secondary education. For example, we found low levels of self-perceived DC in similar proportions among boys and girls in all of the secondary school years studied, which is consistent with the results of previous research (Jin et al., 2020). However, the proportion of students who reported having a high level of DC was higher in boys than in girls, with girls showing a higher tendency to perceive themselves as having a medium level of DC. This difference was statistically significant for students in their final year of secondary education.

The fact that boys reported higher DC self-perception scores than their female classmates coincides with results reported in the existing literature (Cussó-Calabuig et al., 2018; Ardies et al., 2015). Having confidence in one's own abilities, especially in relation to the use of DTs, is in line with the attributes socially associated with masculinity (Ruiz Repullo, 2016), and a lack of female mentors and successful role models to imitate, and a lack of recognition or equal career opportunities for girls (Gasgupta & Stout, 2014), would reinforce differences in that behavior. These are factors that, in turn, are associated with scientific and technological self-efficacy: boys show more interest in science and enjoy using technology more than girls do (Stoet & Geary, 2018). Therefore, although there could be other factors that also influence or affect these differences, such as socio-economic status (Amor & Serrano, 2019), the research reported here indicates that gender is a key factor to consider when endeavoring to understand how DC self-perceptions develop over the course of secondary school education.

Our results also show that DC self-perception tends to improve over time, both for girls and boys. As discussed in previous studies (Jin et al., 2020), students are expected to acquire greater digital competence as they receive more education and training in this specific area. However, gender-based differences between male and female students continue to exist even as this development occurs. This suggests,

again, that gender stereotypes could be negatively impacting girls from an early age, and that the weight of that impact may be increasing with each year in school (Bian et al., 2017).

However, when the specific indicators for DC were analyzed in more detail, it became clear that girls do not always see themselves as having a lower level of DC compared to boys. In the study reported here, girls perceived themselves as having significantly greater skill in performing activities that were primarily academic (making digital concept maps before writing) and related to multimedia (determining whether presentations given by their classmates were too simple). In contrast, boys reported greater skill in technical activities (connecting to the most secure WiFi network) and communications (sending a 2GB video to friends over the Internet, and working collaboratively on a shared document in the cloud). These differences reflect those previously reported by various authors (Amor & Serrano, 2019; Bunz et al., 2007; Martínez-Piñeiro et al., 2019). However, all of these differences disappear by upper secondary school, at which point, in this study, girls no longer reported higher levels of competence than boys in any of the indicators. It is therefore prior to the upper secondary school phase when action must be taken to help girls improve their DC self-perception.

Siddiq and Scherer (2019) suggested that gender-based differences may exist more in relation to specific domains included in the way DC is conceived than in overall DC, results that may contribute to a more nuanced understanding of the digital gender gap. This means that instead of only determining whether some students perceive themselves as generally more or less competent than others do, it is worthwhile to focus on which specific aspects of DC the students perceive themselves as having more expertise in as a way of understanding the types of educational inequalities being perpetuated, and that therefore must be addressed. Our results show that boys consider themselves more competent in aspects that align with attributes related to masculinity. For example, boys reported having a greater inclination towards technological aspects, again in agreement with Siddiq and Scherer (2019), while girls reported higher competence in aspects more closely related to feminine attributes, such as being more studious and more service-oriented (Dasgupta & Stout, 2014).

In relation to the second variable studied, boys reported having a better attitude towards DTs than girls do. This was true across educational levels, but especially for students in the 4th year of ESO. These results are in line with previous research in which girls have reported a more negative attitude towards DTs (Cussó-Calabuig et al., 2018).

In contrast to the results for DC, a general worsening of attitude towards DTs was found to exist over the course of secondary education, for both for boys and girls. However, that downward trend was only statistically significant for girls.

Although a lack of interest among girls in using DTs as academic tools could help explain this result (Cai et al., 2017), another potential explanation when examining this issue from a gender perspective can be found in the higher levels of interest and enjoyment that boys report in relation to studying technological subjects (engineering, ICT), compared to their female classmates (Stoet & Geary, 2018).

Finally, the significant positive correlation found between attitude towards DTs and levels of self-perceived DC points to a need, for both girls and boys, to improve attitude so that DC self-perception can in turn be improved. This is a relationship that also coincides with the results of previous research (González-Martínez et al., 2018; Jan, 2017), and it is one that is especially important in relation to coeducation for girls. This is because it suggests that if teachers can start addressing this attitude in primary school through specific forms of education and mentoring programs, girls may be encouraged to better identify and appreciate real applications of DTs. This could increase girls' interest in learning about aspects that have been historically associated with masculine attributes, such as the more technical DC skills in which they currently consider themselves less competent.

This study does have some limitations, the most significant of which are its non-probability sampling and quantitative focus. Random sampling that covers all of the regions of Spain will be required in the future to confirm our results, using an approach that would correct the imbalance created by the lower number of 2nd year upper secondary students who participated in the survey. This imbalance could represent a methodological limitation when trying to identify differences because the size of the group studied influences the level of significance determined by statistical tests and may only be able to produce a medium effect size. A larger subsample of 2nd year upper secondary students could make it possible to identify additional differences, while also yielding a better understanding of how the digital gender gap evolves during the last two years of secondary school.

In addition, there is a need to supplement the quantitative snapshot given here with additional research into the relationships among all of the potentially-involved variables. There is clearly a need for further research with a gender-based perspective that can take more qualitative aspects into account. That research should focus on all educational stages, beginning in primary school, in order to not only measure but also understand the relationships among social and demographic variables such as the students' socio-economic status, repetition of years, future aspirations, and motivations.

In conclusion, the results of this research have revealed the existence of a digital gender gap in relation to specific aspects of students' self-perceived digital competence. These differences were found to increase, rather than decrease, over the course of students' years in secondary education. This digital gap is especially evident in the way that girls' attitude towards DTs get worse over time, which seems

to also have a negative impact on their self-perception of DC. This scenario has important implications for schools and teachers, including the need to develop coeducational strategies (Heredero, 2019) that take the indisputable digital gender gap into account. To do this, there is a need to address the concept of DC and its various indicators in detail as a way to eliminate the gender-based differences which continue to exist throughout the years of secondary education. For girls, this requires a focus on their lower self-perception in relation to technical aspects, and the less positive attitude they report towards DTs.

Educational actions of this type need to be initiated in primary school, which is the stage where gender stereotypes begin to exert an influence over students (Bian et al., 2017). However, work in parallel must also be performed to close the gender gap that is observed among students in their first years of secondary school and then more intensively during upper secondary school. This is the only way to achieve real equality that will allow women to thrive in a society that demands the efficient, secure, critical, and responsible use of digital technologies.

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APPENDIX 1.

Factorial Analysis of Digitalis-ESO and comparative analysis of DC and Attitude towards DTs indicators, by gender and grade level. https://doi.org/10.5281/zenodo.7643087

- Table 1. Results of DC and attitude towards DTs analyses for the total sample by gender
- Table 2. Results of DC and Attitude towards DTs analyses for the 2nd year of ESO by gender.
- Table 3. Results of DC and Attitude towards DTs analyses for the 4th year of ESO by gender.
- Table 4. Results of DC and Attitude towards DTs analyses for 2nd year of upper secondary by gender.

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Assessment of entrepreneurial orientation and its relationship with gender and academic performance

Evaluación de la orientación emprendedora y su relación con el género y el rendimiento académico

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ABSTRACT

Entrepreneurial orientation is a key concept in the organizational context that is becoming increasingly important in the educational field, since the promotion of entrepreneurship has become one of the European Union's main areas of action in relation to education. Given that the *Escala de Orientación Emprendedora* - Entrepreneurial Orientation Scale (EOE) is one of the few instruments that enable the assessment of entrepreneurial orientation among students, the first aim of the present study was to adapt it to Basque and validate it in that language (EOE-E). The second aim was to examine the relationship of entrepreneurial orientation with gender and academic performance. The sample comprised 735 students in vocational training. In relation to the first aim, the Confirmatory Factor Analysis corroborated

the six-factor structure of the original questionnaire, presenting acceptable internal consistency and stability over time indexes. Evidence of convergent validity and evidence of validity based on relations with other variables, such as self-efficacy and personal initiative was also obtained. The results therefore confirm that evidence was obtained of validity and reliability of the instrument for assessing entrepreneurial orientation among students in vocational training. In terms of the second aim, men were found to have higher mean scores than women for competitiveness, whereas women scored higher than men for learning orientation. Furthermore, in comparison with their lower-performing counterparts, students with better academic grades scored higher for innovativeness, proactiveness, achievement orientation and learning orientation.

Keywords: entrepreneurial orientation, entrepreneurship, test adaptation, gender, academic performance, vocational training

RESUMEN

La orientación emprendedora es un concepto clave en el contexto organizacional que está adquiriendo una relevancia cada vez mayor en el ámbito educativo, ya que la promoción del emprendimiento se ha convertido en una de las líneas de acción más importantes de la Unión Europea en materia de educación. Dado que la Escala de Orientación Emprendedora (EOE) es uno de los pocos instrumentos que permiten evaluar la orientación emprendedora en estudiantes, el primer objetivo del presente estudio consistió en la adaptación al euskera y la validación de la EOE (EOE-E). El segundo objetivo fue examinar la relación de la orientación emprendedora con el género y con el rendimiento académico. La muestra estuvo compuesta por 735 estudiantes de Formación Profesional. En cuanto al primer objetivo, el Análisis Factorial Confirmatorio corroboró la estructura de seis factores del cuestionario original, presentando índices aceptables de consistencia interna y estabilidad temporal. Se recabaron evidencias de validez convergente y de relación con otras variables, tales como la autoeficacia y la iniciativa personal. Por lo tanto, cabe afirmar que se obtuvieron evidencias de validez y fiabilidad de la EOE-E para la evaluación de la orientación emprendedora en estudiantes de Formación Profesional. En lo que respecta al segundo objetivo, los varones presentaron puntuaciones medias superiores a las de las mujeres en orientación competitiva, mientras que las mujeres superaron a los varones en orientación al aprendizaje. Además, en comparación con el estudiantado de menor rendimiento académico, los y las estudiantes con mejores calificaciones académicas mostraron una mayor orientación a la innovación, orientación proactiva, orientación al logro y orientación al aprendizaje.

Palabras clave: orientación emprendedora, emprendimiento, adaptación de test, género, rendimiento académico, formación profesional

INTRODUCTION

Several authors have pointed out that the study of entrepreneurship based solely on personality traits poses conceptual and methodological problems, since personality traits are usually static and theories based on them tend to underestimate the influence of situational factors on actions (Athayde, 2009). In light of this, and given the importance of taking in account those aspects of entrepreneurial competence that can be learned and developed, the present study focuses on the construct known as entrepreneurial orientation (EO), which was initially conceptualized in the organizational environment.

The theoretical antecedents of EO date back to Mintzberg (1973), who defined entrepreneurship as a willingness to search for new opportunities in spite of uncertainty. However, it is the work of Miller (1983) that is largely acknowledged as laying the groundwork for the construct. According to this author, an entrepreneurial company is one that is committed to market innovation, willing to engage in risky activities and determined to discover and implement innovations in a proactive manner. This definition highlights innovation, risk-taking, and proactiveness, the same aspects that have traditionally been identified as the dimensions of EO. In the organizational environment, innovation refers to a company's predisposition to engage in innovative initiatives, experimentation and creative actions that may lead to new products, services or technological processes. Risk-taking is conceived as the willingness to engage in daring actions and earmark meaningful resources in unknown and uncertain environments. Proactiveness is defined as the search for opportunities and a vision of the future characterized by a desire to develop new products and services that anticipate future market trends. Based on Miller's classification (1983), Lumpkin and Dess (1996) broadened the concept of EO and proposed a new classification that included two additional dimensions: competitive aggressiveness and autonomy. Competitive aggressiveness is defined as the tendency to try and outperform one's competitors in order to enter or improve one's position in a market. Autonomy refers to independent actions carried out by leaders or teams with the aim of putting into practice an idea that seeks to identify new opportunities. Some years later, Krauss et al. (2005) revalidated Lumpkin and Dess' classification and incorporated two more dimensions into their theoretical model of EO: learning orientation and achievement orientation. Achievement orientation refers to the constant establishment of challenging goals and persistence in achieving said goals. Learning orientation, on the other hand, alludes to a desire to learn from both positive and negative experiences.

Although the concept of EO has traditionally been associated with the organizational context, over recent years much interest has arisen in studying EO in the educational field (Gorostiaga et al., 2019). This interest is linked to the fact

that entrepreneurial skills and attitudes can be learned and may, in turn, lead to the development of an entrepreneurial culture that benefits individuals, organizations and society in general (Bacigalupo et al., 2016). Indeed, the development of entrepreneurial capacities among European citizens and organizations has become one of the key political aims of the European Union and its Member States (Bacigalupo et al., 2016). Currently, the European Commission defines entrepreneurial competence as one of the eight key competences required for lifelong learning (European Commission, 2019).

In the educational field, it is important to distinguish between the concept of EO, the concept of entrepreneurial potential and the concept of entrepreneurial intention. EO can be defined as the psychological orientation of those who often come up with innovative and creative ideas for solving problems, and tend to be proactive, autonomous and competitive in diverse aspects of their lives, accepting the risks involved in their decisions and maintaining a clear orientation towards achievement and learning (Gorostiaga et al., 2019). Bernal-Guerrero and Cárdenas-Gutiérrez (2017) define entrepreneurial potential as the set of capacities an individual may develop during the formation of their entrepreneurial identity, and point out that it is comprised of several different indicators, including autonomy, initiative, creativity and cooperative spirit. For her part, Athayde (2009) identified five dimensions of entrepreneurial potential, namely: creativity, leadership, intuition, achievement and personal control. Finally, entrepreneurial intention can be defined as a mental state that directs an individual's attention and actions towards situations of self-employment, as opposed to situations of being employed (Fayolle & Gailly, 2015).

The conceptualization of the dimensions of EO in the educational field is, in general, based on the original definitions developed in the organizational environment (Krauss et al., 2005; Lumpkin & Dess, 1996; Miller, 1983), although a change of reference is necessary to ensure that they refer to teaching activities and other everyday activities, rather than specifically to business-like initiatives. For example, Bolton and Lane (2012) point out that some students are more innovative and others less, some students take risks and others do not, some work autonomously and others prefer the comfort of a group, and some are very competitive and seek always to be top of their class, whereas others are happy just to pass. Consequently, with the logical adaptations and bearing in mind the individual nature of the construct in the educational field, the original definitions can be used to assess the dimensions of EO in education (Bolton & Lane, 2012; Kurniawan et al., 2019; Reyes et al., 2014).

As regards the association between EO and other relevant variables in both the organizational and educational fields, it is worth noting that several studies carried out in the entrepreneurial context have analyzed the relationship of this construct

with self-efficacy and personal initiative. Self-efficacy is defined as an individual's trust in their own ability to complete a task successfully (Bandura, 1977). This personal judgment plays a key role in motivation, which in turn determines an individual's effort and perseverance for achieving certain goals (Al Issa et al., 2019). Researchers in the field of entrepreneurship have defined entrepreneurial self-efficacy as an individual's trust in their own ability to successfully perform various roles and complete various tasks linked to entrepreneurship (Chen et al., 1998). EO has been found to be positively associated with both entrepreneurial self-efficacy (Crespo et al., 2020; Eniola, 2020) and general self-efficacy (Gorostiaga et al., 2019; Mohd et al., 2014). The concept of personal initiative was initially proposed by Frese et al. (1996) in the organizational field. Following several previous conceptualizations, Frese and Fay (2001) eventually defined personal initiative as the set of behaviors that characterize individuals who are entrepreneurial, proactive and persistent in the face of any obstacles that may arise in the pursuit of their goals. In the educational field, EO has been found to correlate positively with personal initiative (Gorostiaga et al., 2019; Koop et al., 2000; Krauss et al., 2005).

In contrast to the associations of EO with self-efficacy and personal initiative, which have been clearly reported in the extant literature, the results found to date in relation to gender have been inconsistent. Hardly any research has focused on the relationship between EO and academic performance, a key variable in the educational field. Several studies have reported that men have higher levels of EO than women (Bilić et al., 2011; Kee & Rahman, 2018), whereas others failed to find any gender differences at all (Hunt, 2016; Ogunleye & Osagu, 2014). Moreover, in those cases in which differences have been observed, they vary across the dimensions of EO. For instance, many studies have found that men score higher than women for innovation (Kee & Rahman, 2018; Reyes et al., 201). However, some authors observed no differences between men and women in this sense (Arham et al., 2020; Kumar et al., 2021). In terms of risk-taking, most studies report men scoring higher than women (Lim & Envick, 2013; Marques et al., 2018), although some found no gender differences in this dimension (Arham et al., 2020; Kumar et al., 2021; Reyes et al., 2014). As for proactiveness, some studies report women scoring higher than men (Marques et al., 2018), whereas others report the opposite (Arham et al., 2020; Kee & Rahman, 2018; Kumar et al., 2021). Finally, in relation to competitive aggressiveness and autonomy, most studies report that men score higher than women for both these aspects (e.g., Lim & Envick, 2013). In this sense, it is interesting to note that a recent study in the educational field by Gorostiaga et al. (2019) found gender differences in two out of the six dimensions of EO analyzed, specifically competitiveness, in which men scored higher than women, and learning orientation, in which women scored higher than men.

As stated earlier, only a few studies have focused on the association between EO and academic performance. In one of these, the authors observed that proactiveness, innovativeness and autonomy were positively associated with academic performance (Phelan et al., 2013). In another, Rivai et al. (2018) found a positive correlation between academic performance and EO, whereas Ramesh et al. (2018) found an inverse relationship between these two same variables.

We previously referred to the association between EO and variables such as self-efficacy and personal initiative. Several studies have shown that EO has a positive impact on students' entrepreneurial intention and mediates the relationship between entrepreneurial education and this same variable (Otache et al., 2022; Pérez et al., 2022). This serves to highlight the importance of EO in the educational context, which is why it is vital to be able to assess it in a precise and adequate manner. Despite this, however, most of the instruments that are available for measuring this construct have been developed and are used in the organizational context, with only a very few being available in the educational field. Moreover, most of these have been validated with university students and are based on the three dimensions defined by Miller (1983) and Covin and Slevin (1989) (e.g., Mutlutürk & Mardikyan, 2018; Sulphey & Salim, 2021), the five dimensions defined by Lumpkin and Dess (1996) (e.g., Bolton & Lane, 2012; Kurniawan et al., 2019; Lee et al., 2011, adapted to Spanish by Boada-Grau et al., 2016), or another theoretical model (e.g., Athayde, 2009, adapted to Spanish by Bernal-Guerrero et al., 2021). In contrast, non-university students and the theoretical EO model proposed by Krauss et al. (2005) have hardly been taken at all as references for the development of instruments designed to assess EO in the educational field. Nevertheless, we believe that, in the educational context, the achievement orientation and learning orientation dimensions of said theoretical model are of particular importance. In keeping with this approach, a recent study developed an EO questionnaire called the *Escala de Orientación Emprendedora* - Entrepreneurial Orientation Scale -EOE- (Gorostiaga et al., 2019). This instrument is innovative in that it is the only one based on the dimensions of EO proposed by Krauss et al. (2005), even though, following the validation process, the autonomy dimension was eliminated due to inadequate functioning. Moreover, the scale was validated with vocational training students, a population that is close to accessing the labor market. We therefore believe that the scale is a useful instrument for assessing EO in the educational field.

As well as being validated in the sector in which the target construct is designed to be measured, an assessment instrument should also be adapted to the cultural context in which it is to be used. Based on this conviction, and bearing in mind that 20.5% of the population in the Autonomous Community of the Basque Country (Spain) speaks Basque as their first language (Basque Government, 2019), the main aim of the present study was to adapt the Entrepreneurial Orientation Scale (EOE;

Gorostiaga et al., 2019) to the Basque language and culture. Given that no instrument exists to assess EO in Basque, the present study seeks to fill an important gap in the Basque education sector. Furthermore, since the results obtained to date regarding gender have been inconsistent, we believe it is important to continue exploring the differences that may exist between men and women in the educational context in relation to EO. Finally, given the importance of academic performance in this context and the fact that the research community has paid very little attention to date to the link between this variable and EO, we also aim to analyze this association here. The exploration of possible differences in EO in accordance with gender and academic performance is therefore the second aim of the present study.

METHOD

Participants

We accessed a list of all vocational training centers in the Autonomous Community of the Basque Country through the Basque Government's General Directorate of non-University Teaching Centers. A series of strata were defined on the basis of qualification level (advanced and intermediate) and type of center (public or private), and the centers in each of the four resulting categories were then sorted into a random order. In the academic year in which the sample was recruited, 59% of students were enrolled on advanced-level vocational training courses, 56% in public training centers and 44% in private ones; and 41% were enrolled on intermediate-level vocational training courses, 63% in public training centers and 37% in private ones. In order to ensure that the sample was representative, our aim was to obtain a minimum sample size of 500 people, based on the assumption that 20 students from each selected vocational training center would agree to voluntarily participate in the study. We contacted 112 centers to invite them to participate. Of these, 66 ran advanced-level courses and 46 intermediate-level courses. Of the former, 37 were public and 29 private; and of the latter, 29 were public and 17 private. The sample selection procedure was therefore random and stratified, with proportional and cluster-based allocation. A favorable response was received from 9 centers (7 public and 2 private) running advanced-level vocational training courses and 5 centers (4 public and 1 private) running intermediate-level vocational training courses. The definitive sample comprised 735 vocational training students (322 women, 388 men, 25 of non-specified gender) aged between 16 and 53 years (M = 20.42; SD = 5.32). Participants were enrolled on 30 different advanced (50.1%) and intermediate-level (49.9%) courses at 14 vocational training centers in the Autonomous Community of the Basque Country (Spain); 62.2 %

were studying at public centers and 54.1 % had previous work experience. The distribution of the sample across the 12 different professional areas identified was as follows: Health (19.4 %), Mechanical Manufacturing (18.5 %), Social-cultural and Community Services (18.3 %), Administration and Management (9.2 %), Installation and Maintenance (7.3 %), Physical and Sporting Activities (6.1 %), IT and Communications (4.8 %), Personal Image (4.7 %), Commerce and Marketing (3.6%), Agriculture (2.9 %), Electricity and Electronics (2.6 %) and Hospitality and Tourism (2.5 %).

Instruments

Basque version of the Entrepreneurial Orientation Scale (EOE-E)

This scale comprises 31 items that assess six dimensions of EO: (a) Innovativeness (e.g., "I like innovative teachers more than traditional ones"); (b) Risk-taking (e.g., "In order to create something of value, you need to take risks"); (c) Proactiveness (e.g., "I take the initiative whenever I have the opportunity to do so"); (d) Competitiveness (e.g., "I usually compete with my classmates"); (e) Achievement orientation (e.g., "I get a special feeling whenever I achieve a goal (in my studies, in sport, etc."); and (f) Learning orientation (e.g., "I like people who never stop learning"). Responses are given on a five-point Likert-type scale ranging from 1 (Totally disagree) to 5 (Totally agree). The original version of the instrument was found to have adequate psychometric properties. Specifically, evidence was found supporting a six-dimension structure and attesting to gender invariance and convergent validity with the Entrepreneurial Attitude Scale (Gorostiaga et al., 2019).

Basque version of the Scale for Measuring Personal Initiative in the Educational Field (EMIPAE-E; Gorostiaga et al., 2018).

This scale comprises 17 items that assess three dimensions of personal initiative: (a) Proactiveness and prosocial behavior (e.g., "I am willing to learn from the experiences and knowledge of my teachers and classmates"); (b) Persistence (e.g., "When faced with changes and/or difficulties in the classroom/workshop/laboratory, my level of effort drops" - reverse-scored item); and (c) Self-starting (e.g., "I usually try to put the ideas I have in the classroom/workshop/laboratory into practice"). Responses are given on a five-point Likert-type scale ranging from 1 (Totally disagree) to 5 (Totally agree). In the present study, the internal consistency indexes (McDonald's omega) were .86, .82 and .71, respectively, for the Proactiveness-Prosocial Behavior, Persistence and Self-starting dimensions.

Entrepreneurial Attitude Scale (Roth & Lacoa, 2009)

This is a unidimensional instrument that assesses entrepreneurial attitude through a set of statements linked to proactiveness, propensity to excellence, effectiveness seeking, trust in success, and resilience. It comprises 15 items (e.g., "I am not afraid to take on new initiatives) rated on a four-point Likert-type scale ranging from 1 (Totally disagree) to 4 (Totally agree). The instrument has adequate psychometric properties (Roth & Lacoa, 2009). In a previous study (Balluerka et al., 2014), minor modifications were made to six of the items to adapt them to the cultural context of the Basque Country. In the present study, we used this modified version and the internal consistency index (McDonald's omega) was .86.

General Self-Efficacy Scale (Baessler & Schwarzer, 1996; Spanish adaptation by Sanjuán et al., 2000)

This instrument assesses perceived personal competence in dealing effectively with a wide variety of stressful situations. It comprises 10 items (e.g., "I can always manage to solve difficult problems if I try hard enough") rated on a ten-point Likert-type scale ranging from 1 (Totally disagree) to 10 (Totally agree). The Spanish adaptation has adequate psychometric properties (Sanjuán et al., 2000). In the present study, the internal consistency index (McDonald's omega) was .88.

Sociodemographic questionnaire

This questionnaire was developed ad hoc for the present study in order to collect information on gender, age, training center, academic level (intermediate or advanced), the professional area to which the course being studied belonged, course, academic performance, previous work experience, and profession (in the case of having had previous work experience).

Procedure

First, the items were adapted to the Basque-speaking population, following the standards accepted by the scientific community (Hernández et al., 2020). The items of the EOE-E were translated from Spanish to Basque using a direct-reverse translation design. To this end, each item in the Spanish version was translated into Basque independently by two people who were fluent in both languages and familiar with both cultures, and who had previously been trained in the basic

psychometric aspects linked to item construction. The two translations were then compared and discussed until a consensus version was obtained for each item. This consensus version in Basque was then translated back into Spanish independently by another two people with the same characteristics as those who carried out the direct translation, and a consensus version was reached using the same method. Finally, the four members of the translation team compared each of the items in the original and reverse-translated versions of the instrument to analyze any possible lack of equivalence regarding meaning, and made the necessary modifications to the final Basque language version of the instrument.

This version was then used in a pilot study with a sample of 178 vocational training students (46.6% men) enrolled on nine different courses in three centers located in the Autonomous Community of the Basque Country. Of these, 59% had previous work experience. A series of quantitative analyses were carried out in this pilot study. Specifically, we calculated the mean, standard deviation, homogeneity index and non-response percentage for each item. The means varied in accordance with the dimension to which the items belonged, with the highest values being found in the Achievement orientation (M = 4.03) and Learning orientation (M = 4.19) dimensions, and the lowest ones being found in the Competitiveness dimension (M = 2.73). As regards standard deviations, with the exception of four items with deviations of less than 0.8, all the others had a value close to or over 1 (with the mean of all deviations being 0.95). The mean homogeneity index was .45, with only four items having values under .30, although in two cases the index was very close to the established cut-off value. The proportion of missing data was under 5% for all items. A series of qualitative analyses were also carried out, in which participants were asked to indicate any terms they did not understand. The number of terms identified was very low. Finally, two items were redrafted as a result of their homogeneity indexes and because the authors believed they contained terms that needed to be modified in order to improve comprehension.

Finally, the Basque version of the Entrepreneurial Orientation Scale (EOE-E) was administered, alongside the instruments required for its validation, to a broad, representative sample of participants. All participants completed the battery of questionnaires in group sessions in their respective vocational training centers. In all cases, participants' informed consent was obtained prior to administering the battery of questionnaires. To protect their anonymity, participants were randomly assigned a numerical code that they were asked to indicate at the top of each instrument. The instruments were administered in the following order: sociodemographic questionnaire, EOE-E, EMIPAE-E, Entrepreneurial Attitude Scale and General Self-Efficacy Scale.

The study was approved by the Ethics in Research and Teaching Commission at the University of the Basque Country (UPV/EHU).

Data analysis

With the aim of analyzing the dimensions of the EOE-E, different Confirmatory Factor Analysis (CFA) models were tested. The Weighted Least Squares Mean and Variance adjusted (WLSMV) method was used as estimation method. The Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA) were used as goodness of fit indexes. In the case of the CFI and the TLI, values of over .90 are deemed to indicate good fit. In relation to the RMSEA, values of under .08 indicate acceptable fit, and values of under .06 indicate good fit (Hu & Bentler, 1999).

For the reliability analysis, first, we estimated the internal consistency of each of the dimensions of the EOE-E using McDonald's omega coefficient, and second, we calculated the stability over time of the instruments using the Pearson correlation coefficient. Stability over time was analyzed in a sub-sample of 84 participants, with a time interval of four weeks between the first and the second administration of the instrument.

To obtain evidence of the convergent validity of the EOE-E, we calculated the Pearson correlation coefficients between the scores obtained by participants in the different dimensions of the scale, and those obtained in the Entrepreneurial Attitude Scale (Roth & Lacoa, 2009). Evidence of validity based on relations to other variables was obtained by calculating the Pearson correlation coefficients between the EOE-E dimensions and the EMIPAE-E dimensions, as well as between the EOE-E dimensions and the General Self-Efficacy Scale.

Finally, in order to fulfil the second aim of the present study, gender differences in the dimensions of the EOE-E were analyzed, along with differences between participants with high (grades awarded: high merit or distinction) and low (grades awarded: pass or fail) academic performance. These comparisons were carried out using Student's *t*-test. Cohen's *d* was calculated to estimate the effect size of the differences observed.

The descriptive analyses were performed using the M-Plus (v. 8.0) and SPSS (v. 26) software packages.

RESULTS

First, we present the results of the adaptation of the EOE to the Basque language, followed by the results pertaining to the study's second aim.

Aim 1: Dimensional structure

Table 1 shows the goodness of fit indexes of the CFA models tested. The unidimensional CFA was found to have poor fit. The six-factor CFA, tested in order to confirm the structure of the Spanish version of the instrument, had a better fit than the unidimensional model. Nevertheless, the modification indexes indicated that the fit of this model could be improved by allowing item 18 to be part of several dimensions. The decision was therefore made to allow this item to weigh in two of them. Moreover, item 28 was eliminated for weighing in several different dimensions. The fit of this last modified model was close to acceptable. The standardized factor loadings resulting from this model are presented in Table 2. All loadings were statistically significant and over .40, except for those corresponding to items 13 and 20, which were above the .30 threshold.

Table 1
Goodness-of-fit indexes of the CFA models

Models	χ^2 (*df*)	CFI	TLI	RMSEA (90% CI)
1-dimension CFA	3993.6 (464)	.55	.51	.102 (.099-.105)
6-dimension CFA	1554.51 (449)	.86	.84	.058 (.055-.061)
Modified 6-dimension CFA	1270.55 (418)	.89	.87	.053 (.049-.056)

Note. χ^2: Chi squared; *df*: degrees of freedom; CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; RMSEA: Root Mean Square Error of Approximation; CI: Confidence Interval.

Table 2

Standardized factor loadings resulting from the modified 6-dimension CFA model

Items	F1	F2	F3	F4	F5	F6
Item 6	.661					
Item 13	.378					
Item 18	.417					
Item 25	.681					
Item 1		.556				
Item 7		.430				
Item 8		.485				
Item 17		.685				
Item 29		.677				
Item 5			.669			
Item 16			.520			
Item 18			.449			
Item 27			.781			
Item 2				.633		
Item 3				.581		
Item 9				.446		
Item 19				.588		
Item 20				.302		
Item 24				.663		
Item 30				.637		
Item 10					.481	
Item 11					.591	
Item 14					.583	
Item 23					.589	
Item 31					.437	

Items	F1	F2	F3	F4	F5	F6
Item 4						.585
Item 12						.588
Item 15						.634
Item 21						.503
Item 22						.621
Item 26						.530
Item 32						.679

Note. Appendix 1 presents the items of the EOE-E in Basque, along with their English translation.

Aim 1: Reliability

Table 3 presents the means and standard deviations, along with the McDonald's omega indexes and the test-retest correlations for each dimension of the EOE-E.

Table 3
Reliability indexes for the EOE-E

Dimension	M(SD)	McDonald's omega	Test-retest correlation
Innovativeness	15.12 (2.66)	.65	.43**
Risk-taking	17.70 (3.26)	.71	.38**
Proactiveness	9.95 (2.19)	.73	.58**
Competitiveness	21.51 (5.58)	.76	.64**
Achievement orientation	19.39 (2.80)	.67	.56**
Learning orientation	28.46 (3.81)	.79	.60**

**$p < .001$.

Aim 1: Convergent validity

The Pearson correlation coefficients between the scores obtained in the six dimensions of the EOE-E and the Entrepreneurial Attitude Scale were .27, .25, .47, .24, .32 and .33 (p = .001), respectively, for the innovativeness, risk-taking, proactiveness, competitiveness, achievement orientation and learning orientation dimensions.

Aim 1: Correlations between the dimensions of the EOE-E and the EMIPAE-E dimensions and General Self-Efficacy Scale

Table 4 shows the Pearson correlation coefficients between the six dimensions of the EOE-E and the three dimensions of the EMIPAE-E (proactiveness-prosocial behavior, persistence and self-starting) and the General Self-Efficiency Scale. Said table reflects the positive, moderate correlations observed between innovativeness and the proactiveness-prosocial behavior dimension of personal initiative. Proactiveness, achievement orientation and learning orientation showed positive moderate correlations with proactiveness-prosocial behavior and self-starting dimensions of personal initiative. Proactiveness also correlated positively and moderately with self-efficacy. Other statistically significant correlations were observed, but none of them reached a moderate effect size ($r \geq .30$).

Table 4
Pearson correlations between EO dimensions and the dimensions of personal initiative and self-efficacy

	Personal initiative			Self-efficacy
	Proactiveness-prosocial behavior	Persistence	Self-starting	
Innovativeness	.40**	.23**	.20**	.22**
Risk-taking	.14**	-.07	.27**	.19**
Proactiveness	.39**	.06	.46**	.40**
Competitiveness	-.12*	-.20**	.27**	.14**
Achievement orientation	.40**	-.01	.39**	.14**
Learning orientation	.50**	.07	.36**	.18**

*$p < .05$; **$p < .001$.

Aim 2: Differences in Entrepreneurial Orientation based on gender and academic performance

In relation to the second aim of the present study, Table 5 presents the results of the comparisons between the mean scores obtained by men and women in the different EO dimensions.

Table 5
Mean scores, standard deviations, Student's t values and Cohen's d values in the comparisons between the scores obtained by men and women in the different dimensions of the EOE-E

	Gender	N	M	DT	Student's *t*	Cohen's *d*
Innovativeness	Women	322	15.58	2.61	3.98**	0.30
	Men	388	14.79	2.66		
Risk-taking	Women	322	17.79	3.30	0.58	0.04
	Men	388	17.64	3.20		

	Gender	N	M	DT	Student's *t*	Cohen's *d*
Proactiveness	Women	322	14.09	2.57	2.75*	0.21
	Men	388	13.54	2.74		
Competitiveness	Women	322	18.22	4.81	-6.21**	0.47
	Men	388	20.44	4.69		
Achievement orientation	Women	322	19.83	2.70	3.70**	0.28
	Men	388	19.05	2.88		
Learning orientation	Women	322	29.69	3.36	7.87**	0.59
	Men	388	27.53	3.85		

*$p < .05$; **$p < .001$.

As shown in Table 5, men obtained higher mean scores than women in competitiveness, whereas women scored higher in learning orientation. In the case of innovativeness, proactiveness and achievement orientation, although the gender differences observed were statistically significant, their effect size was small.

Table 6 presents the results obtained in the different EOE-E dimensions by students with high and low academic performance.

Table 6

Mean scores, standard deviations, Student's t values and Cohen's d values in the comparisons between students with high and low academic performance

	Performance	N	M	SD	Student's *t*	Cohen's *d*
Innovativeness	Low	158	14.56	2.59	-5.07**	0.59
	High	136	16.09	2.57		
Risk-taking	Low	158	17.94	3.32	-0.54	0.06
	High	136	18.14	2.89		
Proactiveness	Low	158	12.96	2.50	-5.71**	0.67
	High	136	14.63	2.49		

	Performance	N	M	SD	Student's *t*	Cohen's *d*
Competitiveness	Low	158	19.45	4.35	0.57	0.07
	High	136	19.14	5.04		
Achievement orientation	Low	158	18.77	2.71	-4.08**	0.48
	High	136	20.01	2.51		
Learning orientation	Low	158	27.53	3.49	-4.25**	0.50
	High	136	29.26	3.50		

**$p < .001$.

As shown in Table 6, students with high grades (high merit or distinction) scored higher for innovativeness, proactiveness, achievement orientation and learning orientation than their counterparts with low grades (pass or fail).

DISCUSSION AND CONCLUSIONS

The principal aim of the present study was to develop and validate the Basque version of the EOE (used to assess EO in the educational field), providing evidence of its validity and analyzing its reliability in a broad sample of vocational training students. The main results obtained indicate that the psychometric properties of the EOE-E are similar to those found for the original Spanish version.

In terms of the dimensions of the EOE-E, although the fit indexes obtained were slightly poorer than in the original version of the scale, the CFA confirmed the six-dimension structure of said version (Gorostiaga et al., 2019), with most of the items saturating clearly in their corresponding dimensions. The internal consistency indexes for the different dimensions also had slightly lower values than in the original version, as did the stability over time indexes for all six dimensions of the EOE-E, although all were acceptable. As regards the pattern of correlations observed between scores in the EOE-E dimensions and the Entrepreneurial Attitude Scale, we can state that said pattern provides evidence of the convergent validity of the Basque version of the instrument. As in the study by Gorostiaga et al. (2019), in the present study, the EO dimension that correlated most strongly with entrepreneurial attitude was proactiveness, along with (to a lesser extent) achievement orientation and learning orientation. This may be explained by the fact that the items of the Entrepreneurial Attitude Scale assess aspects such as proactiveness, propensity to excellence, effectiveness seeking, trust in success and resilience.

In terms of the evidence attesting to the validity of the instrument based on relations to other variables, consistently with that observed in several other studies (Crespo et al., 2020; Eniola, 2020; Mohd et al., 2014), the six dimensions of the EOE-E correlated positively with self-efficacy, although in our study, proactiveness was the only dimension that reached a moderate effect size. This finding coincides with that reported by Gorostiaga et al. (2019), who found that, in comparison with the rest of the dimensions, proactiveness explained most of the variance observed in self-efficacy. Consistently also with the results of previous research (Gorostiaga et al., 2019; Koop et al., 2000; Krauss et al., 2005; Nsereko et al., 2018), four of the dimensions of EO correlated positively and moderately with the proactiveness-prosocial behavior and self-starting dimensions of personal initiative. However, no important correlations were observed between any of the dimensions of EO and persistence. This finding may be due to the fact that the persistence dimension of personal initiative focuses more on stubbornness in the achievement of self-started goals, as well as on continuing to pursue an action despite difficulties and on the individual's determination to keep going (Frese & Fay, 2001).

In sum, the results obtained during the validation of the Basque language version of the EOE enable us to assert that, although the reliability indexes are slightly lower than those reported in the original version, the evidence indicates that the instrument is valid for assessing entrepreneurial orientation among Basque-speaking students in the educational context.

In terms of the second aim of the present study, statistically significant gender differences were observed in relation to all the dimensions of EO, with the exception of risk-taking, although said differences only reached a moderate effect size in two cases. Specifically, men scored higher than women in the competitiveness dimension, a finding that is consistent with that reported by previous studies (Gorostiaga et al., 2019; Lim & Envick, 2013); and women scored higher than men in the learning orientation dimension, in keeping with that reported previously by Gorostiaga et al. (2019). The absence of notable differences between men and women in the other dimensions of EO is consistent with the results reported by Hunt (2016) when analyzing the general entrepreneurial orientation construct in the educational field, as well as with the findings of studies focusing on differences in specific dimensions, such as innovativeness (Arham et al., 2020; Kumar et al., 2021) and risk-taking (Arham et al., 2020; Kumar et al., 2021; Reyes et al., 2014). These results suggest that the gender differences observed in the organizational context do not seem to be present to the same extent in the educational field.

In the case of academic performance, our results indicate that, in comparison with their lower-performing counterparts, students with higher academic grades scored higher for innovativeness, proactiveness, achievement orientation and learning orientation. Phelan et al. (2013) also observed a relationship between

academic performance and the proactiveness and innovativeness dimensions. This finding would seem to indicate that a future-oriented outlook, coupled with a willingness to participate and experiment, set goals and learn, is associated with good academic performance. Given the scarcity of studies reporting evidence on the relationship between academic performance and EO, we believe that this finding is novel and supports the viewpoint adopted by the European Commission, which regards entrepreneurial competence as one of the key competences required for lifelong learning.

The present study has some limitations that should be taken into account when interpreting the results. First, the data were obtained using a cross-sectional design, what affects the possibility of establishing causal relationships. Second, all the assessment instruments used were self-report measures. This may have resulted in a bias linked to the common variance method. Future studies may wish to consider the possibility of obtaining information from other sources also, such as teachers. Moreover, self-report measures may affect the honesty with which participants respond to the items, although when the construct being measured is not particularly sensitive in nature (as is the case here), self-reports are usually fairly accurate. Third, we were not able to determine whether or not differences existed in the dimensions of the EOE-E in accordance with the professional areas to which the vocational training courses on which participants were enrolled belong. Finally, since participants were all vocational training students, future studies may wish to try and replicate these results with high school and/or university students. This would provide additional evidence of the validity of the EOE-E and would broaden the scope of the conclusions drawn in relation to EO and its association with gender and academic performance.

To conclude, we would like to highlight the contributions made by the present study. From a practical perspective, it offers a new instrument which enables the EO construct to be assessed in the Basque language. EO is a key construct that should be included in all training programs and entrepreneurial education initiatives implemented in the educational field with the aim of fostering entrepreneurship, a competence that may, in the medium term, improve students' job prospects and future professional development. As such, it is vital to have valid, reliable instruments for measuring EO.

From a theoretical perspective, the present study provides additional evidence of the associations between the different EO dimensions and gender and academic performance, as well as confirming their relationship with self-efficacy and personal initiative. Over recent years, many studies have been carried out with university students, although fewer have focused on students at lower educational levels. Some of these have been carried out with primary and secondary school students (Bernal-Guerrero & Cárdenas-Gutiérrez, 2017). However, as Athayde (2009) argues,

it is increasingly important to orient business policies towards young people, which is why entrepreneurial culture should be fostered from very early on. The present study helps further our existing knowledge regarding entrepreneurial competence in vocational training, an educational level that is of great interest, since students enrolled on these courses are very close to entering the labor market.

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APPENDIXES

Appendix 1
EOE-E items and their English translation

Item	Basque version	English translation
	Innovativeness dimension	
6	*Irakaskuntza metodo berriak erabiliz gauzak modu desberdinean egiten dituzten irakasleak gustatzen zaizkit*.	I like teachers with a different approach and who make use of new teaching methods.
13	*Nahiago dut lanpostu errepikakorra eduki, lanpostu sortzailea baino*.	My goal is to have a job that is more about routine than creativity. (Reverse-scored item)
18	*Ideia berriak/berritzaileak sortzen diren taldeetan lan egitea eta parte hartzea gustatzen zait*.	I like to work and take part in groups where new or innovative ideas emerge.
25	*Gehiago gustatzen zaizkit irakasle berritzaileak tradizionalak baino*.	I like innovative teachers, more than traditional ones.
	Risk-taking dimension	
1	*Bizitzan arrakasta edukitzeko batzuetan arriskatu egin behar da*.	You have to take risks at times in order to be successful in life.
7	*Erabaki arriskutsuak hartzea gustatzen zait*.	I like to make risky decisions.
8	*Zerbait baliotsua sortzeko, aurretik huts egitea beharrezkoa da*.	In order to create something of value, you have to be prepared to make mistakes.
17	*Arrisku handiak hartzen dituzten pertsonak miresten ditut*.	I admire people who assume large risks.
29	*Zerbait baliotsua sortzeko, arriskuak hartu behar dira*.	In order to create something of value, you need to take risks.
	Proactiveness dimension	
5	*Iniziatiba hartzen dut horretarako aukera dudan bakoitzean*.	I take the initiative whenever I have the opportunity to do so.

Item	Basque version	English translation
16	*Askotan lehenengoa naiz klasean gauzak proposatzen*.	In class I'm often the first person to propose things.
18	*Ideia berriak/berritzaileak sortzen diren taldeetan lan egitea eta parte hartzea gustatzen zait*.	I like to work and take part in groups where new or innovative ideas emerge.
27	*Iniziatiba izatea gustatzen zait, egiten ditudan ia gauza guztietan*.	I like to take the initiative in almost everything I do.
	Competitiveness dimension	
2	*Nire gelakideekin lehiatu ohi naiz*.	I usually compete with my classmates.
3	*Niretzat lehiakorra izatea bertutea da*.	For me, being competitive is a good thing.
9	*Bizitza, oro har, lehia hutsa da*.	Life in general is all about competition.
19	*Askotan ahal dudan guztia egiten dut besteak gainditzeko*.	I often strive to be better than others.
20	Nahiago dut lehiatu beharrik ez izatea.	I prefer not to have to compete. (Reverse –scored item).
24	*Ikasleen artean lehiakortasuna sustatzen duten irakasleak gustatzen zaizkit*.	I like teachers who encourage competitiveness among their students.
29	Askotan nire ikaskideekin apustua egiten dut, beraiek baino hobea naizela zerbaitetan.	I often bet my classmates that I'm better than they are at something.
30	*Etorkizunean enpresari gisa ikusten naiz, beti lehiatzen*.	I see myself becoming a businessman/ woman and always competing.
28	--	
	Achievement orientation dimension	
10	*Zeregin batekin hasi aurretik, helburuak argi finkatzeko beharra dut*.	Before beginning a task I need to set myself some clear goals.

Item	Basque version	English translation
11	*Niretzat garrantzitsua da nire burua hobetzen saiatzea (ikasketetan, kirolean…)*.	Trying to do better (in my studies, in sport, etc.) is important to me.
14	*Emozio berezia sentitzen dut helburu bat lortzean (ikasketetan, kirolean…)*.	I get a special feeling whenever I achieve a goal (in my studies, in sport, etc.).
23	*Gustatzen zait erronka suposatzen duten helburuak jartzea (klasean, kirolean…)*.	I like to set myself goals that imply a challenge (in class, in sport, etc.)
31	*Helburu handi bat lortzeko, helburu txikiagoetan zatitzen dut*.	In order to achieve a goal I usually break it down into smaller objectives.
	Learning orientation dimension	
4	*Etengabe gauza berriak ikasteko aukera ematen didan lanpostua eduki nahiko nuke*.	My goal is to have a job where I am constantly learning new things.
12	*Akatsetatik ikasi egiten da*.	You learn from your mistakes.
15	*Bizitza etengabeko ikaskuntza da*.	Life is a constant learning process.
21	*Ikasteari inoiz uzten ez dion jendea gustatzen zait*.	I like people who never stop learning.
22	*Egunero gauza berriak ikasten saiatzen naiz*.	I try to learn new things every day.
26	*Enpresa ondo joateko, langileek etengabe ikasten aritu behar dute*.	For a company to be successful, its employees have to be learning all the time.
32	*Beti esperientzietatik ikasten saiatzen naiz*.	I always try to learn from my experiences.

Note. The original item numbering has been used.

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Gender differences in mental rotation test: a geometry-teaching perspective

Diferencias de género en test de rotación mental: una perspectiva desde la enseñanza de la geometría

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ABSTRACT

According to reports in the literature, males score higher on certain mental rotation tests and complex problem-solving exercises than females. This study analyzes the types of errors made in the Primary Mental Abilities (PMA) space relations sub-test test by 328 secondary school students (ages 13 to 16), 143 of whom, having exhibited complex mathematical problem-solving abilities, were participating in a mathematical talent enhancement programme. The error types detected are defined in terms of angle of rotation of the object and the presence of symmetries in the items of the test. The findings show significantly higher performance in the more mathematically gifted students. Gender differences are only evidenced in the total score of the test and the number of non-answered items, where boys got higher scores than girls. Moreover, there is no significant interaction between the independent variables gender and complex mathematical problem-solving abilities. The conclusions drawn from those findings introduce nuances in the understanding of the gender

difference traditionally identified in visualisation, particularly in connection with geometric properties in mental rotation tests. It is stressed that educational research focuses on other aspects, like emotional or behavioural ones that can impact test execution, like speed or the use of less efficient strategies.

Keywords: mental rotation, PMA test, complex problem solving, gender differences

RESUMEN

De acuerdo con la literatura, los hombres obtienen puntuaciones superiores a las mujeres en ciertas pruebas de rotación mental y en ejercicios de resolución de problemas complejos. Este estudio analiza los tipos de errores cometidos en la subprueba de relaciones espaciales de habilidades mentales primarias (PMA) por 328 estudiantes de secundaria (edades comprendidas entre los 13 y 16 años). De ellos, 143 participaban en un programa de estímulo del talento matemático, dado que habían mostrado habilidades en la resolución de problemas matemáticos complejos. Los tipos de errores detectados se definen en términos del ángulo de rotación del objeto y la presencia de simetrías en los ítems del test. Los resultados muestran un rendimiento significativamente mayor de los alumnos con alta habilidad matemática. Las diferencias de género únicamente se evidencian a favor de los chicos en la puntuación global del test y en el número de ítems no contestados. Sin embargo, no se encuentran diferencias de género en ninguno de los tipos de errores asociados a las propiedades geométricas de los ítems. Además, no existe interacción significativa entre las variables independientes género y habilidad para la resolución de problemas complejos. Las conclusiones extraídas de esos hallazgos introducen matices en la comprensión de las diferencias de género identificadas tradicionalmente en las habilidades de visualización, particularmente en relación con las propiedades geométricas en las pruebas de rotación mental. Se enfatiza que la investigación educativa puede focalizarse en otros aspectos, como pueden ser los emocionales o actitudinales que afectan al proceso de realización de los test, como la rapidez o el uso de estrategias menos eficientes.

Palabras clave: rotación mental, test PMA, resolución de problemas complejos, diferencias de género

INTRODUCTION

The literature has identified differences by gender, with males scoring higher in performance on standardised tests measuring a command of mathematics (Hyde et al. 1990; Scheiber et al. 2015, among others) or spatial abilities (Halpern et al., 2007; Voyer & Saunders, 2004), mental rotation in particular (Hyde, 2014; Xu et al., 2016). Gender differences are less obvious when other measuring tools are used, however (Ganley & Vasilyeva, 2011; Gibbs, 2010). Some studies, assessing classroom learning or skills defined in the curriculum, have found girls to score

higher than boys (Corbett et al. 2008; Liu & Wilson, 2009; Voyer & Voyer, 2014; Yarbrough et al., 2017). A number of authors have observed women to perform better as a rule in tests measuring numerical skills, and men in tasks calling for mathematical reasoning (Gibbs, 2010; Scheiber et al., 2015).

These differences have clear educational implications, as the practice with spatial tasks can bridge the gender gap in this type of reasoning (Rodán et al., 2022; Wu & Shah, 2004). As an example, evidence was found that mental rotation training can improve performance in mathematical tasks like calculation problems (Cheng & Mix, 2014). In this sense, visual-spatial abilities can condition success in STEM areas (Science, Technology, Engineering and Mathematics), where girls take advanced courses or related degrees to a lesser extent (Reinking & Martín, 2018). Research literature on gender differences documents the intertwined nature of spatial and mathematical development, suggesting that the activities aimed to increase spatial abilities can have positive effects on mathematics learning by students (Johnson et al., 2021). If the differences obtained stemmed from the implied mathematical contents, then the results would provide guidelines for the design of tasks and learning process, because those differences would need to be attended through proper diversity awareness instruction. This would also have consequences in the design of curricular programs, training of teachers and classroom planning, because the tasks presented would be more effective if the educational potential is maximized by bridging the differences (Rodán et al., 2022). However, recent meta-analysis showing that spatial training is effective to improve mathematical understanding and performance highlights a poor understanding of the mechanisms that support transfer and demands more theoretically-guided studies (Hawes et al., 2022).

The first stage in that endeavour is the establishment of relationships between spatial skills and mathematics. Some authors have contended that spatial abilities may determine mathematical performance, particularly as regards geometry (Ganley & Vasilyeva, 2011). A possible explanation of the role of mental rotation in mathematical scores is related to problem-solving strategies (Delgado & Prieto, 2004). Geometric problem solving, unlike simple arithmetic or numerical tasks, may be impacted by factors other than mathematical ability, such as visuo-spatial aptitudes (Clements, 1980; Delgado & Prieto, 2004; Harris et al., 2021). The effect of spatial abilities might explain the differences in solving complex problems where they are required. Some authors have found men to be better at solving geometric problems requiring visualisation (González-Calero et al., 2018; Ramírez-Uclés et al., 2013). Others, in contrast, have reported that although gender differences can be found among secondary school students in spatial visualisation and performance in geometric tasks, no such differences were observed in the ability to reason or in the strategies used to solve geometric problems (Battista, 1990). At the same time, several studies have shown that greater mathematical ability to solve problems

translated into higher mental rotation test scores (Ramírez-Uclés et al., 2013) and in geometrical tasks involving visualization (for example, Rabab'h & Veloo, 2015; Ramírez & Flores, 2017; Rivera, 2011).

In an attempt to explain that variability, several reviews and meta-analyses have identified complexity as a factor with a bearing on gender differences in mathematics performance (Else-Quest, et al., 2010; Lindberg et al., 2010). Studies on gender differences that detected no significant variation in numerical errors, geometric notions or basic mathematical concepts and competence in addition, nonetheless reported men to solve complex mathematical problems more effectively than women (Stewart et al., 2017). In that same vein, other authors who observed no gender differences in simple tasks or spatial ability found boys significantly better able to deal with more difficult tasks (Manger & Eikeland, 1998). Such gender differences have also been identified in tests that measure mathematical talent (Benbow & Stanley, 1996).

In this research the tool at issue was broached from a descriptive perspective, given that a number of studies have detected evidence that the characteristics of a given task may explain the gender differences observed in mental rotation tests (Lauer et al., 2019). The aim here focused on understanding gender-related differences in performance on a mental rotation test depending on the geometric complexity of the test item. More specifically, the question posed was: can the uneven performance between girls and boys be attributed to the geometric characteristics of the mental rotation test itself? The primary aim would be to ascertain whether gender differences are due to the geometric properties of mental rotation in terms of the presence of symmetries and different angles of rotation. No universally accepted indication supports the premise that such characteristics specifically determine gender differences. The processes carried out during the test determine the participants' efficiency in solving a spatial task, so differences might well stem from factors identified in other studies, such as test scoring, response time limitations or the use of effective strategies (Contreras et al., 2012).

In this sense, attempts have also been made to understand the differences between boys and girls not only in their cognitive ability to solve complex problems requiring mathematical reasoning, but also in their approach to schoolwork and learning strategies, classroom behaviour or self-regulation, mathematical self-efficacy and planning and attention strategies (Yarbrough et al., 2017). Gender differences have been detected in self-confidence, with women exhibiting less (Preckel et al., 2008), for instance, in situations in which they scored lower if they were aware that the task at hand was intended to reveal gender differences (Spencer et al., 1999) or in competitive contexts where they proved to be more sensitive to pressure (Niederle & Vesterlund, 2010). Bench et al. (2015) provided helpful insight into self-confidence. When completing a mathematics test, men

were observed to judge their success more highly than women, creating a positive bias. Nonetheless, women who had scored earlier success in mathematics likewise over-estimated their own performance (Bench et al, 2015). Consequently, in this study subjects' mathematical ability was deemed of significance in understanding the gender differences associated with stereotypes in mathematics.

Gender differences were broached essentially from a psychometric perspective, analysing subjects' performance on a standardised test (Steinmayr & Spinath, 2008; Wach et al., 2015). Some earlier studies have identified test administration or scoring procedures, such as limiting the time allowed (Maeda & Yoon, 2016; Peters, 2005) or using raw scores (Goldstein et al., 1990; Stumpf, 1993), that may condition such differences, whereas other authors have found no evidence of the effect of such factors (Voyer et al., 2004; Yoon & Mann, 2017). This research deployed the Primary Mental Abilities spatial relations tool (PMA-SR, Thurstone & Thurstone, 1943), a mental rotation test in which men and subjects with complex problem-solving ability have been observed to perform better, although no interaction between those two variables has been detected (Ramírez-Uclés & Ramírez Uclés, 2020).

Gender differences in the PMA-SR sub-test

Gender differences have been identified in PMA-SR performance (Campos, 2014; Lauer et al., 2019; Linn & Petersen, 1985; Stericker & LeVesconte, 1982). PMA-SR elements may be effectively analysed with both spatial strategies (differentiating among rotated reflection symmetries) and 'analytical' problem solving, which involves comparing the characteristics of the stimuli to identify matching features (shape, for instance). The latter procedure has been observed to be used more by women than by men (Linn & Petersen, 1985). Men may rely more on spatial strategies that entail visualising the rotation of objects or parts thereof, whereas women may rely more on strategies that involve comparing the characteristics of stimuli (such as size, shape and colour of the components and their inter-relationships) (Just & Carpenter, 1985; Pezaris & Casey, 1991). Although the reasons for gender differences in strategy use are unknown, the deployment of different strategies has been reported to be a source of inter-sex variation in mental rotation skills during child development (Lauer et al., 2019). Investigations with tasks similar to PMA items, with rotated letters in mirrored form, showed that the strategy used comprised mental rotations of the images until being vertically oriented, and then another rotation out of the plane to return it to normal position (Núñez-Peña & Aznar-Casanova, 2009). When carrying out such process to identify the correct answers in the PMA test, items related to larger angles or presenting symmetries required more time for checking. This strategy, applied to the PMA

test (see the example shown in Figure 1), could differentiate between the actions required in image A (rotate 90 degrees to compare with the sample) and B (rotate 45 degrees and apply a symmetry). However, another strategy could be to compare between the different alternatives, as when B is rotated 45 degrees to yield C, which is directly equal to the symmetrical of the sample. Although gender difference does not help in correctly solving the task, it can condition the selection of a certain process that can be more efficient in finding the solution (Contreras et al., 2007; Peña et al., 2008).

Some strategies can be rooted in geometric rationale, eschewing a strictly visual approach. When realising that a composition with two symmetries was tantamount to rotation, for instance, one of the students correctly identified the plane-rotated figures by applying symmetries to the incorrect answer. As an example, answer D (Figure 1) can be rotated to obtain a figure that is symmetrical to C, which is in turn symmetrical to the sample, and therefore D can be obtained as a rotation of the sample. A better spatial sense (National Council of Teachers of Mathematics, 2000) rather than spatial visualisation alone would infer higher potential performance in this test, for certain elements of background knowledge and geometric relationships could likewise be called into play.

That supports the utility of exploring items' geometric characteristics, for several studies on spatial tests have shown the angle of rotation and presence of symmetries to affect scores. The time needed to find the correct answers varies depending on the angle of rotation and rises with the presence of reflections (Petrusic et al., 1978; Núñez-Peña & Aznar-Casanova, 2009). Wider angles of rotation have also been associated with a rise in complexity and a decline in performance (Alansari et al., 2008; Xu et al., 2016). Nonetheless, in some PMA items with a fairly high rate of erroneous replies a larger angle of rotation was not found to induce greater complexity (Cruz & Ramírez, 2018). As noted in earlier papers, that may have been because the impact of certain biased items on the total score was marginal only (Maeda & Yoon, 2016).

In light of the lack of research on the properties of spatial tests, specific research is demanded on the geometric characteristics of the direction and angle of rotation contained in items associated with gender differences (Maeda & Yoon, 2016) and on the complexity of the geometric shapes used in such tests (Arendasy & Sommer, 2012). This study is a response to such calls for research to determine whether cognitive processes may differ depending on the characteristics of the stimuli (such as object shape, rotation direction and angle, rotational task complexity) and whether the way some of those features are deployed is sex-related (Maeda & Yoon, 2016). This article addresses two types of mistakes made on the PMA spatial relations sub-test, characterised in terms of two geometric properties, angle of rotation and presence of symmetries. The aim is to analyse differences between

boys and girls and between more and less mathematically skilled students. From the above premises, the study stems from the following hypothesis: 1) subjects with better mathematical abilities obtain better results in the analyzed test; 2) boys get higher scores in tests tan girls, but no gender differences are observed derived from the geometrical properties; and 3) there could be an interaction between the independent variables gender and mathematical ability in relation to the dependent variable test score.

METHODOLOGY

Participants

The sample comprised 328 secondary school students between the ages of 13 and 16 (mean: 15; standard deviation: 0.97), 143 of whom (sub-sample Complex Problem, CP) were participating in a mathematics talent enhancement programme underway in two Spanish regions, specifically Andalucía and Castilla-León. The uneven distribution by gender in this sub-sample was the result of the smaller number of girls in the programme, an issue faced in earlier studies as well (Hyde, 2014). The 184 subjects in the control sub-sample (No Complex Problem, NCP) were enrolled in different secondary schools in the same regions as the CP students, none of whom had been identified by their teacher as having complex mathematical problem-solving abilities (Table 1).

Table 1.
Sample distribution by gender and complex problem-solving skill

	CP	NCP	Total
Men	103	96	199
Women	40	89	129
Total	143	185	328

Note. CP (Complex Problem), NCP (No Complex Problem).

Instruments

The Spanish language version of the Thurstone (Thurstone & Thurstone, 1976) Primary Mental Abilities Test - Spatial Relations published by TEA Ediciones was used in this study. The Cronbach's alpha index calculated for this sample was 0.89, which compares to 0.93, the value indicative of reliability or internal consistency. This test measures the ability to interpret and recognise objects that change their position in space while retaining their internal structure. It is a tool often used in classroom evaluations, it is administered in five minutes and can be administered to a whole group with a few simple instructions. Each of its 20 items depicts a sample figure and six others, some of which were the result of rotating the sample around a central point (plane rotation). The remaining options were images involving symmetries and plane rotations. Each correctly identified plane-rotated figure scored as a correct answer whereas defining symmetries as plane rotations constituted an incorrect answer.

No geometric terminology (rotation, angles, symmetries) was used in the instructions for taking the test, which referred to the correct options as the figures 'that are exactly the same as the sample but in a different position'. For the incorrect answers the instructions were 'None of the others is identical to the sample, for even if you set them upright, they are backwards or upside-down'.

Allusion was made to visual strategies to identify them: 'You only need to set them up straight to see they're exactly the same'; 'Don't turn the test sheet around. Leave it flat without lifting it off the desk. You have to turn [the figures] around mentally to see what they would look like'. Three examples with the respective answers were given, noting that 'the total number of identical figures may vary from row to row'. In Figure 1, for instance the correct answers were identified as A, D and F.

Figure 1
Example provided in the test instructions

One of the particulars of the tool is that as subjects have no way of knowing the number of correct options in each item or the scoring criteria, they cannot determine the possible advantage of omitting or responding to an item when in doubt. The total score was computed as the number of correct less the number of incorrect choices, whilst two types of errors were possible: excluding a rotation or including a symmetry.

Procedure

The 143 subjects participating in the mathematics enhancement programme (sub-sample CP) were assumed to have complex mathematical problem-solving ability. To be eligible for the programme they had to pass an entrance exam based on solving complex, non-routine problems involving logic, arithmetic or geometry. The following is an example:

> *"A magic square is a 3x3 matrix such that adding the numbers in all the rows, columns and diagonals gives us the same sum. That value is the square's 'magic sum'. Could there be a magic square with nine consecutive odd numbers, seven of which are prime numbers? What would those numbers be?"*

The tests were administered to each group collectively, with examinees answering on paper and within the 5 min allowed. Participation in the test, administered by the researchers in the programme classroom for sub-sample CP and the standard classrooms for sub-sample NCP, was voluntary.

Design and variables

The independent variables in the 2x2 bifactorial intergroup design were (boy or girl) and mathematical ability (CP, in possession of complex mathematical problem-solving ability; or NCP, control sub-sample). The dependent variables were the total score in PMA test, the sets of error indicators and the types of error (described below).

Type of error

Imperfect performance in an item was the result of failing to checkmark all the identical options or incorrectly labelling one or more of the non-identical figures as identical. Since the identical figures were rotations and the non-identical figures symmetries, two types of errors were defined: exclusion of rotations and inclusion of symmetries. The geometric characterisation of those errors entailed envisioning the re-positioning needed to convert the initial sample figure into the figure shown in each proposed answer. An analysis of the items revealed that rotations could have acute angles ranging approximately from 30º to 60º, obtuse angles from around 120º to 150º and perpendicular directions forming right angles (Cruz & Ramírez, 2018). Given those characteristics, rotations were classified under four headings: 0º to 90º; 90º; 90º to 180º; and 180º (which in some figures could be interpreted as 0º if composed with the respective symmetry). Counter-clockwise rotation was defined as positive, while the first seven types of error were associated with excluding rotations. Including a symmetry as one of the four types of rotations led to a further seven types of errors (Table 2). Error type 6, for instance, was made when students failed to identify a correct choice in which the figure was rotated 90º relative to the sample. Students making error type 14, in contrast, incorrectly identified a figure obtained with a -90º rotation symmetry as a rotation. One additional type of error consisted in the failure to identify any figure as identical to the sample (type 0 = no answer).

Table 2

Type of error associated with recognition of symmetries and angle of rotation

	0º to 90º	90º	90º to 180º	180º
PR: Positive Rotation excluded	1	2	3	4
NR: Negative Rotation excluded	5	6	7	X
PS: Positive rotation Symmetries included	9	10	11	12
NS: Negative rotation Symmetries included	13	14	15	X

Note. Error types 8 and 16 are included in types 4 and 12 respectively, for the same figure is obtained whether rotated in the positive or negative direction.

Grouping the error types associated with rotations and symmetries yielded the error sets defined in Table 3.

Table 3
Error sets

Indicator	Characteristic	Error types included
PR	Positive Rotations excluded	1+2+3
NR	Negative Rotations excluded	5+6+7
R	Rotations excluded	1+2+3+4+5+6+7
PS	Positive Symmetries included	9+10+11
NS	Negative Symmetries included	13+14+15
S	Symmetries included	9+10+11+12+13+14+15

RESULTS

The data were analysed with 2 x 2 ANOVAs, with the dependent and independent variables as described in the methodology. *Partial eta squared* (η^2_p) was adopted to compute effect size. Statistical significance was set at a confidence interval of 95 %, with $p < .05$ as the criterion. Analyses were run on SPSS software (v. 19 for Windows).

Further to the findings for the total scores in PMA, students with complex problem-solving ability (CP) performed better than the controls (NCP) [$F(1, 324) = 59.43$, $p = .000$; $\eta^2_p = .155$] and girls (F) obtain lower scores than boys (M) [$F(1, 324) = 6.20$, $p = .013$, $\eta^2_p = .019$]. Nor the interaction between the two independent variables was observed to have any significant effect on subjects' performance.

Error sets

As Table 4 shows, the CP students made significantly fewer errors than the NCP controls in all the error indicator sets. They excluded fewer rotations: on the whole (R) [$\eta^2_p = .110$]; and whether positive (PR) [$\eta^2_p = .107$]; or negative (NR) [$\eta^2_p = .085$]. They also included fewer symmetries (S): [$\eta^2_p = .076$], whether positive (PS) [$\eta^2_p = .065$]; or negative (NS) [$\eta^2_p = .075$]. No significant gender-based differences were observed for any of the error sets. Nor was any significant effect found for the possible interaction between independent variables.

Type of error

The findings likewise attested to the significantly fewer errors recorded for the CP students than for the NCP controls in all the error types analysed (see Table 5): Type 0 [η^2_p = .039]; Type 1 [η^2_p = .074]; Type 2 [η^2_p = .040]; Type 3 [η^2_p = .099]; Type 4 [η^2_p = .079]; Type 5 [η^2_p = .023]; Type 6 [η^2_p = .033]; Type 7 [η^2_p = .107]; Type 9 [η^2_p = .046]; Type 10 [η^2_p = .030]; Type 11 [η^2_p = .038]; Type 12 [η^2_p = .027]; Type 13 [η^2_p = .041]; Type 14 [η^2_p = .037] and Type 15 [η^2_p = .078]. As in the error sets, no significant differences were observed in the interaction between the two independent variables for any of the error types analysed. No significant gender-based differences were observed either for any of the error sets.

In relation to the gender differences found in error Type 0, table 6 shows the percentage of unanswered options by item.

Table 4
Mean, standard deviation, and F-values for error sets by gender and mathematical ability

	CP				NCP						
	Boys		Girls		Boys		Girls		F test: F-values (1, 324)		
	M	SD	M	SD	M	SD	M	SD	M. Ability	Gender	Interaction
	Error set indicator										
PR	1.73	1.35	1.43	0.87	3.11	2.91	3.37	2.65	38.72** (p= .000)	.09 (p=.930)	1.09 (p= .297)
NR	1.08	1.33	1.00	1.24	2.30	2.55	2.71	2.91	29.92** (p= .000)	.37 (p= .541)	.81 (p= .368)
R	3.12	2.70	2.73	1.84	6.49	6.54	7.26	6.75	40.20** (p= .000)	.92 (p= .762)	.87 (p= .353)
PS	0.45	0.74	0.25	0.63	1.15	1.90	1.09	1.47	22.53** (p= .000)	.67 (p= .437)	.19 (p= .667)
NS	0.46	0.87	0.32	0.57	1.40	2.03	1.42	2.18	26.30** (p= .000)	.08 (p= .779)	.15 (p= .703)
S	1.16	1.89	0.77	1.25	3.14	4.73	3.11	4.09	26.63** (p= .000)	.23 (p= .630)	.18 (p= .670)

Note. **p< .01; *p< .05.

Table 5

Mean, standard deviation, and F-values for type of error by gender and mathematical ability

	CP				NCP						
	Boys		Girls		Boys		Girls		F-test: F-value (1, 324)		
	M	SD	M	SD	M	SD	M	SD	M. Ability	Gender	Interaction
						Type of error					
Total score PMA	32.26	9.98	30.55	10.05	23.40	12.57	18.28	11.72	59.43** (*p*= .000)	6.20*(*p*= .013)	1.54 (*p*= .215)
Type 0	6.38	3.83	7.30	3.67	7.66	3.94	9.29	3.73	13.00** (*p*= .000)	9.95** (*p*= .005)	0.62 (*p*= .431)
Type 1	1.23	0.88	1.13	0.68	1.71	1.17	1.91	1.18	25.95** (*p*= .000)	0.15 (*p*= .705)	1.57 (*p*= .211)
Type 2	0.18	0.46	0.20	0.33	0.40	0.71	0.59	1.16	13.41** (*p*= .000)	0.01 (*p*= .938)	0.05 (*p*= .822)
Type 3	0.31	0.59	0.10	0.30	0.81	1.14	0.90	1.11	35.77** (*p*= .000)	0.33 (*p*= .568)	1.57(*p*= .173)
Type 4	0.31	0.63	0.30	0.46	1.07	1.65	1.18	1.68	27.87** (*p*= .000)	0.09 (*p*= .757)	0.14 (*p*= .706)
Type 5	0.28	0.51	0.30	0.61	0.29	0.54	0.55	0.85	7.47** (*p*= .007)	0.16 (*p*= .688)	0.03 (*p*= .852)
Type 6	0.33	0.72	0.37	0.63	0.66	1.03	0.78	1.07	10.94** (*p*= .001)	0.56 (*p*= .456)	0.11 (*p*= .736)
Type 7	0.47	0.70	0.32	0.57	1.15	1.29	1.38	1.67	38.76** (*p*= .000)	0.12 (*p*= .733)	1.83 (*p*= .177)
Type 9	0.20	0.45	0.13	0.40	0.48	0.95	0.55	0.88	15.59** (*p*= .000)	0.02 (*p*= .966)	0.71 (*p*= .398)
Type 10	0.09	0.28	0.05	0.22	0.28	0.69	0.22	0.52	9.88** (*p*= .002)	0.64 (*p*= .424)	0.27 (*p*= .870)
Type 11	0.16	0.41	0.08	0.35	0.39	0.70	0.31	0.57	12.91** (*p*= .000)	1.38 (*p*= .248)	0.05 (*p*= .942)
Type 12	0.25	0.81	0.20	0.40	0.59	1.28	0.61	1.23	9.03** (*p*= .003)	0.25 (*p*= .874)	0.69 (*p*= .783)
Type 13	0.18	0.52	0.15	0.36	0.54	1.06	0.54	1.00	14.02** (*p*= .000)	0.34 (*p*= .854)	0.03 (*p*= .872)
Type 14	0.07	0.25	0.00	0.00	0.21	0.54	0.22	0.55	12.38** (*p*= .000)	0.25 (*p*= .619)	0.66 (*p*= .417)
Type 15	0.20	0.45	0.18	0.38	0.65	0.87	0.65	0.90	27.46** (*p*= .000)	0.02 (*p*= .896)	0.84 (*p*= .843)

**p< .01; *p < .05.

Table 6
Percentage of unanswered options by item

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10
Boys	1.98	2.97	3.96	2.97	2.47	4.95	5.44	12.37	14.85	21.78
Girls	1.55	1.55	3.10	1.55	1.55	6.2	10.82	25.58	20.93	31.00
	Item 11	Item 12	Item 13	Item 14	Item 15	Item 16	Item 17	Item 18	Item 19	Item 20
Boys	35.14	40.09	46.53	53.96	60.39	72.27	76.73	83.16	87.62	89.10
Girls	44.96	52.71	62.01	71.31	78.29	86.04	90.69	92.24	91.47	93.79

DISCUSSION AND CONCLUSIONS

In light of the present findings, the analysis of two types of errors identified in the PMA test can be said to introduce a nuance in the gender- and mathematical ability-based differences observed in earlier studies.

In this study significant differences were found between students with and without the ability required to solve complex mathematical problems. The former made significantly fewer mistakes of all the types analysed, more effectively differentiating between rotation and symmetry irrespective of the angle of rotation. That finding was consistent with earlier reports that associated greater mathematical competence with higher performance in this type of assessment tools (Ramírez-Uclés et al., 2013)

Gender was not found to have a significant effect on any of the errors or error sets derived from the geometrical properties. No gender differences in performance were detected in connection with angles of rotation or symmetries. In other words, being a boy or a girl did not affect the presence of errors consisting in omitting correct answers for a given angle of rotation or incorrectly including a symmetry. That finding would afford an initial response to one of the issues identified in the literature to be in need of attention (Maeda & Yoon, 2016), inferring that the gender differences found in test performance must be due to other factors. Such factors appear to be related to the fact that boys answer more items (Goldstein et al., 1990; Maeda & Yoon, 2016; Peters, 2005). Contrary to earlier reports (Alansari et al., 2008; Petrusic et al., 1978; Xu et al., 2016), no greater complexity was perceived with wider angles of rotation or the presence of symmetries.

However, significant gender differences were observed in the test score and the number of non-answered items, especially those resulting from lack of time (Ramírez-Uclés & Ramírez Uclés, 2020). Table 6 shows that, from item 11 onwards,

more than 50% of girls do not answer thus pointing to the use of strategies that demand more time in the response. Given the specific characteristics of the test and the fact that the subjects are unaware of the number of correct options, we find it interesting to study in future works whether differences stem from personality traits related with poor self-confidence or the need to constantly check the results.

Nor was the interaction between the two independent variables (gender and complex mathematical problem-solving ability) observed to have any significant effect. In the items analysed, a command of complex problem-solving was the feature that determined higher test performance, with no gender-based differences observed. These findings introduce considerable nuance in the understanding of the gender differences traditionally identified in visuo-spatial aptitudes and more specifically in mental rotation. Here more mathematically skilled subjects exhibited higher performance on the test, irrespective of gender. Higher performance may be attributable to other factors forming part of geometric rationale, such as an understanding of properties unaltered by isometry (parallelism, perpendicularity and relative position are all retained), order 2 compositions (a composition with two symmetries is a rotation; one with two rotations a third rotation; one with a rotation and a symmetry, a second symmetry) or analytical strategies (Linn & Petersen, 1985).

Mathematics educators have long stressed the importance of drawing connections between visuo-spatial ability and problem solving (Arcavi, 2003; Clements & Battista, 1992). In addition to visualisation, the classroom development of a sense of space (National Council of Teachers of Mathematics, 2000) entails other features of geometric knowledge, such as movements in a plane and in space. Mental rotation items could be performed more efficiently by subjects with a more highly developed sense of space. Nonetheless, tasks associated with that sense such as those requiring physical construction, mental conversion of foldable or non-rigid objects; or the identification of simple shapes embedded in more complex shapes, not usually deemed mental rotation tasks, are excluded from certain meta-analyses (Lauer et al. 2019). The gender differences detected in mental rotation tests might be more fully understood if research focused at the same time on the geometric rationale involved in performing the tasks in an attempt to address the controversy identified in a number of studies (such as Battista, 1990; and González-Calero et al., 2018). Boys' ability to work faster on this test led to higher performance, for instance. Another area worthy of study would be personality traits, above and beyond cognitive factors, that might affect the deployment of more effective and efficient strategies (Preckel et al., 2008; Yarbrough et al., 2017). Factors such as self-confidence may be an outcome not only of a subject's gender, but also of their mathematical ability (Bench et al., 2015). Given that mental rotation abilities are reportedly improved by fostering motivational beliefs and improving self-

competence perceptions, motivational aspects get relevance in the educational processes to improve mental rotation abilities (Moè, 2021).

Among the limitations of this study, we can highlight that no general intelligence test is included that relates the ability to solve complex problems with the intellectual G factor. In future studies it would be interesting to include both variables to observe the potential relationship between the corresponding constructs. Another limitation of the work is given by the study of a concrete test and a particular sample in which there were different numbers of boys and girls. However, we consider that the results provide interesting educational information in relation to the gender differences found in STEM. In a test traditionally showing gender differences it wasn't proved that such differences stemmed from the geometrical characteristics analyzed.

The fact that the mathematical contents did not cause the differences could shift the focus of the educational process towards saving the differences in emotional and behavioral aspects, such as self-confidence.

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