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Impact of Digital Contexts in the Training of University Education Students

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Abstract: The Internet is an important source of information and is a real ecosystem for learning that has provided important advances in education, although it has also generated problems, especially in terms of data security, identity theft, and cyber-plagiarism. During the COVID-19 pandemic, we had the opportunity to check levels of development in terms of infrastructures and digital competence, and subsequently detected serious problems in online assessment. In particular, the behaviour and digital competence of future teachers are essential, as they will inevitably be role models for their students. The present study analyses academic cyber-plagiarism derived from digital ecosystems during the pandemic in the academic work of pre-service teachers, advancing studies and warnings regarding Artificial Intelligence as a new learning ecosystem. A validated online questionnaire is used that considers the digital context surrounding training both during and after the pandemic. For the factor analysis, both descriptive and correlational, 324 responses from three Spanish universities are analysed. The confirmatory factor analysis reports four factors: the digital context of the pandemic as an opportunity for plagiarism, the response of the educational community to plagiarism, and both the unconscious and intentional misuse of sources. It is concluded that the digital context of the pandemic provided an opportunity for academic plagiarism, conscious or unconscious, with a clear distinction according to gender and the degree of reference. Finally, it is recommended to promote students' digital skills to avoid risks such as cyber-plagiarism or authorship theft, using institutional repositories that can provide students with prominence by safely and ethically publishing their intellectual creations. Similarly, national policies are required to address advances in AI in education.

Keywords: university teaching; digital ecosystem; academic cyber-plagiarism; dishonest practices; initial teacher training

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1. Introduction

The digital transformation of the university world has brought about important benefits for the management, collaborative production, registration, and communication of student work in digital formats, generating changes in effective learning with new learning ecosystems. During the COVID-19 pandemic, many institutions accelerated their digital transformation plans, as was the case for universities. However, during the pandemic, a satisfactory response was not achieved in some areas, mainly in external practices and online assessments. In this situation, regarding the problems suffered by most university institutions, and following the Report on Non-Personal Assessment Procedures [1] that a commission of experts presented for the Council of Rectors of Spanish Universities (CRUE), the use of facial recognition techniques in exams using proctoring technology was discouraged, and it was recommended to diversify assessment techniques, thus gathering more elements.

Three years have passed since the pandemic-induced confinement that moved professional and academic life (jobs, defences of final degree or doctoral theses, exams, etc.) into the home. Scientific articles are still being published [2–4] that share data collected in those moments of uncertainty, and which are of great value for developing strategies with which to respond to the new changes in education and new learning ecosystems, either fully online or hybrid, that many universities are encouraged to implement.

There is now greater sensitivity to people's health and well-being, so there is a greater possibility of people remotely developing their work in justified cases. In many of these cases, it can be normalised and maintained over time. In the academic world, and specifically in the university world, this has filtered into the practice of many teachers, who have discovered the enormous benefits that technologies provide for a large part of the tasks centred on management (planning and collaboration in teaching, department meetings, urgent communications, etc.) and the supervision of academic work online (eAssignments, eTutorials, online assessment, etc.).

However, it is worth examining an issue that has a great impact on the professional and ethical development of university students, especially for the initial training of future teachers as role models for future citizens: the inappropriate use of the Internet for the development of academic work. This was already a highly relevant topic, with important studies on the subject [5–8], but with the experience of the recent pandemic, this concern and related publications have increased and will exponentially continue to do so due to the uncertain future presented by new emerging technologies such as Artificial Intelligence (hereafter, AI) that are stirring things up in this field [9], causing greater uncertainty and concern for teachers [10].

1.1. New Digital Contexts and Old Challenges for Academic Ethics in Universities

We cannot ignore the fact that technology and the Internet have been used in education for years as a resource to support teaching and research. In the wake of the COVID-19 pandemic, their use has come to the fore, and for an extended period they were an essential training and teaching tool. This plunged education into a more intense and wider digital context at all levels of education. Despite being a balm and a resource that was immensely helpful for teachers and students, allowing them to continue their studies, for many it presented an obstacle due to existing limitations in digital competence and difficulties in terms of access and digital inclusion [11]; a concern for teachers who were moving in a new context that they had not yet fully mastered; and a concern that this technology makes it easier to carry out dishonest practices such as academic plagiarism, with an evident lack of control by academics in this new mass digital context.

Despite this problem and practice that calls into question the ethics that a university student—a future professional—must demonstrate, particularly in the field of initial teacher training, we must also look more deeply into the use of technologies and access to the Internet as a source and resource of great value for the educational field, accompanied by the necessary training in its appropriate, ethical, and responsible use. Therefore, before proposing measures and prevention regulations, training plans, and advice for both the prevention of dishonest practices and avoidance of the dangers of the Internet in general, we need to identify the factors that provoke these responses in students, as they are not always aware of them [12]. This is also justified by their lack of knowledge and competence in handling citations and bibliographic references, as well as the poor planning and organisation of faculties, which have an impact on students' stress levels.

1.2. Artificial Intelligence as a Digital Ecosystem and Its Impact on Learning

AI is currently revolutionising hitherto routine processes and mechanisms in many professions, and the duality of technologies in terms of their benefits and the prevention of dangers has been raised once again. Among education professionals, a profound debate has begun with regard to its advantages and disadvantages, including interesting experiences in the use of chatbots in education in different areas [13–15], which do not avoid

a palpable, more generalised concern among teachers regarding the current explosion of artificial intelligence.

It is clear that AI is claiming a place in education and, like many other technologies, requires further study with this dual vision of the impact on learning. In terms of benefits, UNESCO sees it as an opportunity to address the multiple challenges facing education. It recognises that it can also contribute to responding to the Sustainable Development Goals (SDGs) and, therefore, to open and flexible education systems [16]. In this way, we could evaluate and learn more in order to design more personalised programmes in Massive Open Online Courses (MOOCs) [17].

As for the risks, these are still not widely addressed in the university system despite the significant amount of recent research [9,18–20]. This justifies further research into the subject of the new dangers that this technology can generate, what instruments we can create for its study, and how we can provide ethical training in the university community, in general, and in initial teacher training in particular. In order to make this knowledge available for educational action, we need to investigate student practice, which is the specific object and framework of this study, in such a way as to anticipate the new challenge and learning ecosystem that AI will enable. Specificity has been scarce in recent studies that have established this relationship between academic honesty and AI [21]. Recent studies have taken a more holistic and non-specific view, with exploratory and broad studies such as [22] proposing the need for policies with three dimensions: *pedagogical* (improving teaching and learning outcomes), *governance* (privacy, security, and accountability issues), and *operational* (infrastructure and training).

1.3. Students' Knowledge of Academic Cyber-Plagiarism

Studies in the literature on academic plagiarism have intensified in parallel with the rise of new emerging technologies, producing new situations for these studies but also new evidence and tools for the analysis of practices, which always maintain the same objective: to achieve the best impact of technology and to prevent dangers and dishonest practices. These advances and new technological developments establish the creation of new ecosystems that make the situation more complex and generate challenges for its study, producing, at the same time, new terms, sometimes closely related, that have evolved from the same general concept of *plagiarism* and *dishonest practices* [23] to more specific institutional contexts of education, where they take the names *academic plagiarism* and *academic integrity* [24]. This has been extended to digital ecosystems (*academic cyber-plagiarism*) [25] and, more recently, new terms such as *AI plagiarism*. University students turn to the Internet for the development of their work as a source of first-hand information. However, to a greater extent, they lack the guidelines to carry out an exhaustive search, an analysis of the information obtained, and filtering according to the needs of the study and work to be carried out.

While it is true that, as a general rule, before entering university, students write texts or essays based largely on imitation, once they enter the university environment, they are required to write texts with greater reflective depth that are in dialogue with other authors and show a more personal character [26]. The recent study by [25] revealed that copying and pasting from the Internet, together with paraphrasing without citations, are the most common plagiarism practices, highlighting a particular concern among Latin American countries, Asia, and Spain. The study by [27] argued the importance of tutorials to prevent academic cyber-plagiarism, and the proposal of educational actions not only to teach citation and referencing, the university context, and the platforms that exist for its detection [28], but also to explain the importance of honest practices among education professionals.

The pandemic added other elements in terms of stress: the time allocated to solve tasks and digital competence, particularly the self-management of learning in new digital ecosystems and online learning. This was a challenge not only for many teachers, but also for students, as the mastery of technical competence in the use of mobile devices proved to

be insufficient for competence in the self-management of online learning. Therefore, we need to know what general impact the pandemic has had on academic cyber-plagiarism among students of education, and to understand in greater depth what opinions and knowledge students show according to their differences (gender, degree, course level, etc.).

2. Methodology

2.1. Research Design

This study aimed to analyse the perceptions and practices of academic plagiarism from the perspective of university students working towards four educational qualifications (Early Childhood Education, Primary Education, Pedagogy, and a master's degree in Secondary Education). For this purpose, an exploratory, descriptive, and longitudinal study was carried out over three academic years: 2020/2021, 2021/2022, and 2022/2023.

2.2. Participants

A total of 324 students from three different Spanish universities participated, which corresponded to the workplaces of the four authors of the study: University of Vigo (UVigo), University of Extremadura (UEx), and University of Malaga (UMA). Of these students, 265 (81.79%) were women and 59 (18.21%) were men. The age of the participants was between 19 and 26 years. The students who participated in the study belonged to different university degree programmes: Primary Education, Early Childhood Education, Pedagogy, and a master's degree in Teacher Training.

2.3. Instrument

The instrument used was an online questionnaire validated and adapted from a previous study in which it obtained a Cronbach's alpha value of 0.775 [29] and which, for the present research, takes into account the digital context that surrounded the training of these students during and after the COVID-19 pandemic. Information was collected on what dishonest practices they committed during the pandemic, to what extent the pandemic led to these practices, what knowledge and skills these students have with regard to avoiding plagiarism, and whether they consider that after the pandemic, their knowledge and skills have increased.

The questionnaire consists of several items, but in this study, we focused on only three of them:

1. Dishonest practices during the pandemic.
2. To what extent has the COVID-19 pandemic facilitated plagiarism?
3. Do you feel that after the pandemic you have more knowledge and skills to avoid plagiarism?

The first question is answered on a five-point frequency scale: (1) never, (2) very rarely, (3) sometimes, (4) almost always, and (5) always. For the second and third, the scale represents the level of agreement: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree.

With regard to internal consistency, a Cronbach's alpha of 0.785 was obtained for the first two items, which is slightly higher than that in the previous study. This coefficient is associated with the reliability of a measuring instrument and is an indicator of the consistency or stability of the measures taken when the measurement process is repeated under very similar conditions [30]. This internal consistency describes the extent to which the questions measure the same concept and is therefore related to the interrelation of the items within the test [31].

Students from the three participating universities were provided a link to the online questionnaire during class. They were offered a time at which to complete it, and any possible doubts were resolved.

2.4. Data Analysis

First, a factor, descriptive, and correlational analysis was carried out using SPSS version 21.0 statistical software. Subsequently, an analysis of variance and a confirmatory factor analysis were carried out, which clearly reported four factors which we have named according to the interpretation of their item grouping:

Factor 1. The digital context of the pandemic as an opportunity for plagiarism.

- Item 1. The pandemic has promoted plagiarism among students.
- Item 2. The situation of confusion due to the pandemic was taken advantage of by the students to plagiarize.
- Item 3. There was fluid and parallel communication in line between students, which facilitated the plagiarism in the realization of the work.
- Item 4. There was fluid and parallel communication in line between students, which facilitated the plagiarism during the exams.

Factor 2. The educational community response to the plagiarism during the pandemic.

- Item 1. The pupil is sensitized with the author rights, so it did not commit plagiarism during the pandemic.
- Item 2. There are tools and rules that have been discussed to eat plagiarism despite the pandemic.
- Item 3. Teachers were afraid to take online exams because they did not control plagiarism, but it was more fear than reality.

Factor 3. Inappropriate use of sources.

- Item 1. Copying text fragments from websites and–without citation–pasting them directly into a document–in which there is a part of text written by oneself–and handing it in as a subject paper.
- Item 2. Copying extracts from printed sources (books, encyclopedias, newspapers, magazine articles, etc.) and adding them–without citing–as part of a work of one's own as part of a subject.
- Item 3. Copying parts of my own work submitted during previous courses and using them as sections of a new assignment.
- Item 4. Copying images, videos and sounds from google without indicating authorship and source.
- Item 5. Since plagiarism is taking someone else's words and not their material goods, plagiarism is not a big deal.

Factor 4. Intentional impersonation of authorship.

- Item 1. Handing in work done by another student which has already been handed in in previous years (for the same or another subject).
- Item 2. Downloading an entire assignment from the Internet and handing it in, unmodified, as one's own work for a subject.
- Item 3. Doing an assignment in its entirety from extracts copied verbatim from web pages (without any part of the assignment actually having been written by me).

3. Results

Table 1 shows the total variance explained, in which the existence of the abovementioned four factors is observed.

Table 1. Total variance explained.

Total Explained Variance									
		Initial Eigenvalues		Sums of Squared Extraction Charges			Sums of Squared Charges of Rotation		
Component	Total	% Variance	% Accumulated	Total	% Variance	% Accumulated	Total	% Variance	% Accumulated
1	4.284	28.558	28.558	4.284	28.558	28.558	2.991	19.940	19.940
2	2.340	15.599	44.157	2.340	15.599	44.157	2.862	19.078	39.018
3	1.462	9.747	53.904	1.462	9.747	53.904	19.934	12.895	51.913
4	1.133	7.554	61.458	1.133	7.554	61.458	1.432	9.546	61.458
5	0.869	5.791	67.250						
6	0.791	5.270	72.520						
7	0.735	4.901	77.421						
8	0.655	4.369	81.790						
9	0.571	3.808	85.598						
10	0.530	3.536	89.134						
11	0.407	2.716	91.850						
12	0.386	2.575	94.426						
13	0.334	2.227	96.653						
14	0.287	1.914	98.567						
15	0.215	1.433	100.000						

Extraction method: principal component analysis.

The content of the sub-items grouped in Factor 1, "The digital context of the pandemic as an opportunity for plagiarism", shows how the digital context surrounding university education during the pandemic provided an opportunity for students to commit plagiarism, as there was fluid, online communication between students, which they took advantage of in many cases to commit plagiarism in papers and exams. The grouping of sub-items in Factor 2 represents the response of the educational community (teachers, students, and institutions) to the changes to online learning made due to the pandemic. In this case, it is related to the students' awareness of copyright during COVID-19, the concern of teachers when setting online exams due to their concerns regarding plagiarism of the answers, and the existence of tools and rules on the part of the institution that prevented, to a large extent, the use of plagiarism during the pandemic. The sub-items grouped in Factor 3, "Inappropriate use of sources", correspond to dishonest plagiarism practices, though probably carried out unconsciously. This is the case for copying one's own work submitted in previous years in a current subject, which most students assume is not plagiarism. The same applies to the use of images without citation, because they are not considered to be copyrighted. Finally, Factor 4, "Intentional impersonation of authorship", groups together sub-items that speak of plagiarism in a conscious way, in this case speaking of impersonation, such as submitting work by other students from previous years as one's own, presenting an entire piece of work copied from the Internet, or composing a piece of work from fragments taken from the Internet and presenting it as one's own.

Student's *t*-test was used to analyse all the items according to gender, with no significant differences being observed. However, it is worth noting that in most of them, the values reported by women tend to be higher than those reported by men (see Table 2).

In this comparison by gender, it is worth noting that women who participated in the study considered that they had less knowledge about copyright and fewer skills to prevent it (response to item 14.1.), while after the pandemic they considered that they had improved their knowledge about the practices and prevention of plagiarism (response to item 14.2.).

Finally, an ANOVA test was carried out on all the items according to the four participating degrees, showing significant differences between the degrees in Early Childhood Education and Primary Education, especially in the sub-items of the item regarding dishonest practices during the pandemic, where the former degree reported the highest values.

Table 2. Mean item and sub-item scores by gender.

	Woman	**Men**
Handing in work done by another student that has already been handed in.	1.2377	1.2377
Copying text excerpts from websites without citation.	**2.1887**	1.9661
Downloading a complete work from the Internet and handing it in unaltered.	1.1434	1.3559
Copying extracts from printed sources, books, encyclopaedias, newspapers, etc.	**2.2075**	1.8983
Producing a work in its entirety from excerpts copied verbatim.	**1.6075**	1.5424
Copying parts of my work handed in during previous courses.	**2.034**	1.8475
Copying images, videos, and sounds from Google without indicating authorship.	**2.6528**	2.5593
Because plagiarism consists of taking someone else's words and not their material goods, plagiarism is no big deal.	1.7623	1.8475
The pandemic has promoted plagiarism among students.	**3.25**	3.17
The students are aware of copyright and therefore did not commit plagiarism during the pandemic.	**2.28**	2.15
There are tools and standards that have deterred plagiarism despite the pandemic.	**3.25**	3.17
Teachers were afraid to set exams online because they did not control plagiarism, but this was more fear than reality.	**2.28**	2.15
The students took advantage of the pandemic's confusion to plagiarise.	**3.25**	3.17
There was fluid and parallel online communication among students, which facilitated plagiarism in the completion of assignments.	**2.28**	2.15
There was fluid and parallel online communication among students, which facilitated plagiarism during the exams.	**3.25**	3.17
14.1. Do you consider that you have the knowledge and skills to avoid plagiarism?	**2.28**	2.15
14.2. Do you feel that after the pandemic you have more knowledge and skills to avoid plagiarism?	**3.25**	3.17

When interpreting these data, we initially checked and ruled out that it was motivated by the year, since in both degrees (Early Childhood and Primary Education), the participants were in their first and second years. However, we can extract several possibilities that may have motivated these results among the participants of the Early Childhood Education Degree, who are apparently more relaxed about plagiarism. On the one hand, many of these students come from a Vocational Training cycle before entering university; that is, they come from a more practical than academic context, which on many occasions could lead to an act of ignorance or decontextualisation of the academic world. On the other hand, the students of this degree consider that their working future is more practical, without having to write well-referenced and documented essays, as is required in certain academic papers throughout the degree, or in the Final Degree Project. Finally, in one of the universities, the Infant Education degree is the only degree in the Faculty of Education for which there is no teaching material regarding new technologies applied to education, with these infant education groups being almost one hundred percent female, in contrast to what happens in Primary Education in which gender is more balanced, and where these specific copyright issues are dealt with in the class manuals in the educational technology subjects in the other degrees offered by the faculty.

We therefore consider that these gender differences are very likely to be due to a problem related to training in digital skills. This circumstance is reinforced by the women's statement in item 14.1., that they have less knowledge than men about copyright and the skills to prevent it. It is important to mention that in this aspect we speak at all times of a trend, and of an interpretation or hypothesis based on that perceived trend.

4. Discussion

The pandemic at the time, and artificial intelligence today, represents a new "challenge" [18] for the training of professionals and for university institutions. The digital context demands new ways of learning, creating its own ecosystem that is not exempt from the risks of dishonest practices such as plagiarism. In the case that concerns us in this study, in the initial training of teachers, their training in digital competences and academic ethics is key to their role as models of good practice for new citizens.

The analysis of the data obtained shows that one of the determining factors for plagiarism is the digital context, together with the unconscious or intentional inappropriate use of sources and the educational community's own response to plagiarism.

This study has allowed us to gain an insight into the types of practices carried out by the sample of participants during the pandemic, as can be seen in Table 2. It shows that learning from the experience of the pandemic was significantly higher in the case of women. Overall, we found significant differences between two degrees (Primary and Early Childhood Education) by gender, where students in the first years of their degree in Early Childhood Education expressed the highest values in terms of academic cyber-plagiarism. These results are contrary to those of other studies in secondary education [32], in which it was the males who reported the highest number of dishonest practices and the importance of the direct relationship of this practice with the groups that procrastinate and hand in work at the last minute.

The women who took part in this study considered that they had less knowledge about copyright and the skills to prevent plagiarism (response to item 14.1.), while after the pandemic, they considered that they had improved in their knowledge of practices and prevention of plagiarism (response to item 14.2.), obtaining a slightly but significantly higher score than the men, who also showed an improvement in this skill. In any case, the data do not indicate whether there are circumstances that ultimately determine these differences, which we understand to be due to differences in terms of training in digital competence and taking educational technology subjects.

In the literature collected in this paper, we can see how AI has been applied to improve teachers' competences to provide understanding and support performance, while promoting academic honesty and preventing dangers such as academic cyber-plagiarism. Policy makers and academics around the world are discussing strategies for employing AI in various knowledge areas of education, including in developing countries [19], in the pursuit of access, development, and quality in education for all, which is closely linked to the SDGs. This includes stable and sustainable policies related to artificial intelligence to enhance and promote sustainable development in education.

In conclusion, emerging technologies such as AI represent both a challenge and an opportunity for educational institutions. The experience with the pandemic provides us with learning that encourages us to orient in two basic directions for the initial training of education professionals: On the one hand, in a literature review study [20] that analysed 24 national policy strategies on AI, education was largely absent. We therefore need national policies that focus interest on and promote the safe implementation of AI in education. On the other hand, the digital competences of students and the prevention of different risks (cyber-plagiarism, cyber-bullying, security and identity theft, etc.) must be addressed through services such as institutional repositories. It has been proven that these repositories [33] need to take on a greater role in order to allow students and teachers to republish many of their works with greater security and academic ethics. In some respects, this digital incursion under exceptionality has forced digital practices without considering issues such as the quality of the products, provenance, and copyright of many resources. Thus, in subjects that address digital competences and digital content production, production oriented to institutional repositories can be a motivating strategy for students and an opportunity to address copyright and academic ethics.

As in all research, there are limitations in the number of samples and in the methodology of the research design, which points us to correlating variables but does not explain the

causes. Therefore, we need to expand the study with a larger sample and, in turn, propose a more qualitative design, for example, by starting with training seminars on digital skills and copyright, so that this training activity allows us to conduct interviews and focus groups to gain a better understanding of the problem.

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