Digital skills in initial teacher training in Portugal

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Abstract
This article aims to present an analysis of the curricular matrices of the initial teacher training courses of three Portuguese public universities, having as a methodology the documental analysis carried out on the audiovisual materials available on their web portals, aiming to understand in a curricular context, such as the digital technologies are being approached in order to allow future teachers to develop the necessary competences for their integration in the classroom. For this, it was established parameters for analysis, where there is the existence of a specific discipline and the presence of topics related to digital technologies in the syllabus and teaching methods of courses. The results point to the use of different methodologies in each educational institution, but which, in a way, are in accordance with the guidelines of the European Union and the National Reform Program of Portugal in relation to the development of digital skills.

Keywords
digital skills; initial teacher training; curriculum.

As competências digitais na formação inicial de professores em Portugal

Resumo
Este artigo tem como objetivo apresentar uma análise das matrizes curriculares dos cursos de formação inicial de professores de três universidades públicas portuguesas, tendo como metodologia a análise documental realizada nos materiais disponíveis em seus portais na *web*, onde busca-se entender, em contexto curricular, como as tecnologias digitais estão sendo abordadas no sentido de permitir aos futuros professores desenvolverem as competências necessárias para a sua integração na sala de aula. Para isso, estabeleceram-se parâmetros para a realização da análise, em que se verificam a existência de disciplinas específicas e a presença de temas relacionados às tecnologias digitais nos conteúdos programáticos e nos métodos de ensino das demais unidades curriculares. Os resultados apontam para a utilização de metodologias diferentes em cada instituição de ensino, mas que, de certa forma, estão em conformidade com as orientações da União Europeia e do Programa Nacional de Reformas de Portugal em relação ao desenvolvimento das competências digitais.

Palavras-chave
competências digitais; formação inicial de professores; matriz curricular.

Competencias digitales en la formación inicial del profesorado en Portugal

Resumen
Este artículo tiene como objetivo presentar un análisis de las matrices curriculares de los cursos de formación inicial docente de tres universidades públicas portuguesas, teniendo como metodología el análisis documental realizado sobre los materiales audiovisuales disponibles en sus portales web, con el objetivo de comprender, en un contexto curricular, cómo las tecnologías digitales se están abordando con el fin de permitir que los futuros docentes desarrollen las competencias necesarias para su integración en el aula. Para ello, se establecieron los parámetros para el análisis, donde se verifican la existencia de un objeto específico y la presencia de temas relacionados con las tecnologías digitales en los métodos del programa de estudios y la enseñanza de las unidades curriculares. Los resultados apuntan a la utilización de diferentes metodologías en cada institución educativa, pero que, de alguna manera, están en conformidad con las directrices de la Unión Europea y el Programa Nacional de Reforma de Portugal en relación con el desarrollo de habilidades digitales.

Palabras clave
habilidades digitales; formación inicial del profesorado; plan de estudios.

1 Introduction

In an information and knowledge society, at a time of accelerated social and technological transformations, the intensity of production and distribution of information through the various tools and computational resources - which are increasingly accessible with intuitive interfaces - leads us to think about key competencies for lifelong learning (EU, 2006). When analyzing the eight key competencies proposed by the Directorate General for Education and Culture of the European Union (EU), it can be seen that they complement each other, with an interrelation between the skills necessary for the promotion of each.

In this sense, it is important to understand the concept of skills and competencies. According to Silva (2018, p. 55) "[...] skills can be physical or mental and are associated with know-how, that is, the individual's ability to perform a certain task", namely, the skill is the capacity acquired by human beings to use, creatively and habitually, their knowledge during the learning process, applying practice through theory (DANILOV; STATKIN, 1978 *apud* SILVA, 2018).

Silva (2018, p. 55) observes "[...] three functional components in this process: action that leads us to the skill and skill that leads us to operationalization and the construction of the skill itself", and the set of specific skills that interrelate form a competence.

Regarding competencies, Pedro and Matos (2019, p. 347) highlight that "[...] they imply the mobilization and integration of different cognitive resources, seeking to respond to concrete situations", meaning "[...] something that is located in the individual, independent of resources what used are used and transferable to other situations or tasks in a mechanically". In that sense, the competence:

> [...] is not understood as a state, but as something that is revealed and developed in action, created in a continuous process subject to changes throughout the development of each subject, implying the ability to mobilize knowledge within a given context. (PEDRO; MATOS, 2019, p. 347-348).

Thinking about initial teacher training, Perrenoud (2000) states that technology progress allows the development of new skills, while Silva (2018, p. 56) highlights that "[...] teaching methodologies must incorporate digital technologies communication and information as a means to promote a better articulation of content and knowledge [...]".

Araripe and Lins (2020, p. 6) point out that, "[...] despite studies showing that teachers will continue to be essential actors in education [...], there is certainly a need to redefine their role", because, in today's world, "[...] it no longer makes sense to think of teachers as mere content carriers". That is, it is necessary training that enables them to be professionals "[...] reflective of their pedagogical practice, designers of learning experiences, protagonists of their professional training throughout life, and having the ability to innovate in solving complex problems" (ARARIPE; LINS, 2020, p. 6).

Along these lines, the EU developed an initiative entitled DigComp: Digital Competence Framework for Citizens (VUORIKARI et al., 2016), which, based on Europe's digital agenda, established a framework of digital competencies for European citizens. Based on their digital competence matrix, member countries can establish their goals and plans for teachers' digital training, serving as a reference and strategic support for training and monitoring the development of digital competencies. In this framework, it is suggested that digital skills are part of a group of indicators that aim to measure Human Capital and understand the skills needed to develop citizens in the digital society.

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In the Portuguese context, based on the European Digital Competence Framework for Citizens, the INCoDe.2030 program published the Dynamic Framework of Reference for Digital Competence (QDRCD), which has three main objectives: to support the definition of policies and strategies; design education programs and assess and certify skills, either by self-diagnosis or by certifying bodies (PORTUGAL-INCODE.2030, 2017).

In this context and thinking that "[...] teachers are expected to be motivated and able to use different technological resources to support their pedagogical practice" and that it is understood that the integration of digital technologies in the classroom can "[...] enhance student learning" (FONSECA, 2019, p. 4), through a documentary analysis (SAMPIERI; COLLADO; LUCIO, 2013), In this article, we aim to understand how digital competencies development is taking place through the integration of digital technologies in the curricula of initial teacher training courses at three sizeable universities in Portugal.

The basis for this study lies in the fact that:

> [...] despite the encouraging discourse of the different studies that have fought for the introduction of ICT in education, the successive regulations, and the political discourse, the vast majority of teachers, even those who recently graduated, do not integrate ICT into their teaching practice as a resource that enhances meaningful learning. (FONSECA, 2019, p. 4-5).

Thus, the present study aims to carry out a documental analysis of the syllabus of the Master's courses in Teaching (2nd cycle) in three Portuguese university institutions, having as references and parameters for the discussion the DigComp Framework proposed by the EU and the QDRCD, which guides the development of digital skills in Europe and Portugal, respectively.

In practical terms, it is intended to understand if and how the development of digital competencies is approached in the initial training of teachers. To this end, an analysis of the curricular units was carried out, verifying their syllabus and teaching methods, and establishing an analysis framework that aims to indicate whether there they fully, partially, or poorly met the determinations of what is proposed in the object of this study. This framework starts from the observation that the researched university institutions have different levels of strategies to work pedagogically on the development of the necessary competencies so that future teachers can carry out their teaching

planning, although it is perceived that not every master's course addresses the use of teaching methodologies with the use of digital technologies.

This study also seeks to understand how the courses' curricula are helping to improve the preparation of teachers to deal with digital technologies in the classroom, as well as to promote their integration with the proposed contents through planning that takes into account not only technological knowledge but also pedagogical.

2 Methodology

This study is based on a qualitative approach, based on a document analysis supported by a theoretical framework, allowing the authors to position themselves to contribute to the debate and discussion of the results. Methodologically, the research is based on Sampieri, Collado, and Lucio (2013), having as support the web portals of the Masters in Education of the Faculty of Social and Human Sciences of the Nova University Lisbon and the Institutes of Education of the Universities of Lisbon and Minho. In practical terms, the syllabus and teaching methods of the study plans and curricular units of the various qualifications provided by these courses were analyzed, seeking evidence of the integration of digital technologies, whether in a specific curricular component or cross-curricular.

For the analysis of this research, it is assumed that documents, records, materials, and artifacts constitute a valuable source of qualitative data that can help to understand the phenomenon studied. It is understood that the analyzed items are classified as group audiovisual materials, constituting a digital source and available on web pages (SAMPIERI; COLLADO; LUCIO, 2013).

The analysis was carried out during March and April 2021 and took into account only the courses that had documentation available on their websites. 32 courses were checked, eight of Nova University Lisbon[1], 12 of University of Lisbon[2] and 12 of University of Minho[3].

[1] Site: https://www.fcsh.unl.pt/cursos/#mestradosemensino. Accessed on: 19 Aug., 2022.
[2] Site: http://www.ie.ulisboa.pt/ensino/mestrados/mestrado-ensino/cursos. Accessed on: 19 Aug., 2022.
[3] Site: https://www.ie.uminho.pt/pt/ensino/mestrados/paginas/default.aspx. Accessed on: 19 Aug., 2022.

To carry out the analysis, parameters were defined in order to standardize the comparisons of curricular components and their study plans, as shown in Table 1.

Table 1 – Reference standards for the analysis of curricular units

Value	Reference
Fully meet the parameters	When at least one curricular unit of the course addresses in its syllabus, clearly and objectively, the use of digital technologies in the teaching-learning process.
Partially meet the parameters	When at least one curricular unit of the course addresses in its teaching method, clearly and objectively, the use of digital technologies in the teaching-learning process.
Poorly meet the parameters	When at least one curricular unit of the course addresses in its syllabus or its teaching method - implicitly, not objectively, or only as a support tool - the use of digital technologies.
Does not meet the parameters	There is no reference to the use of digital technologies.

Source: Authors' own (2021).

3 Results

The studies by Araripe and Lins (2020) stand out to start the discussion on digital competencies development in initial teacher training. Those studies present how educational institutions responsible for initial teacher education and governments are approaching the integration of digital technologies in the teaching-learning process. Araripe and Lins (2020) analyzed the guidelines for teacher training, as well as their guidelines and policies for teacher training courses in the following countries: Brazil, Australia, Singapore, Chile, India, and Estonia.

In this way, we seek to contextualize Portugal within the scope of this study since it is part of the Bologna Process as well as Estonia (Table 2). In general, the study by Araripe and Lins (2020) demonstrates that the reality of the analyzed countries leads to the same purpose, that is, it seeks to train digital skills for a new global context. In this regard, it is clear that the development of digital skills is related to the knowledge, practice, and professional engagement in the use of digital technologies, requiring information literacy, communication abilities, skills for creating digital content, knowing how to maintain security and privacy and, above all, knowing how to use technologies to solve problems.

Table 2 – Guidelines about digital competencies

Country	Guidelines on Information and Communication Technologies (ICT)
Brazil	Competency benchmarks with explicit insertion of ICT in one of the competencies and specific skills.
Australia	Specific competence benchmarks for ICT, distributed in knowledge, teaching strategies, search for information, and technical knowledge.
Singapore	References for teaching professional competencies, with transversality of ITC, with explicit insertion of ICT in three of them.
Chile	References for teaching professional competencies, with transversality of ITC, with explicit insertion of ICT in three of them.
India	ICT policy document in schooling, including ICT skills building in initial teacher training.
Estonia	Teacher training by level in five years (three undergraduate and two master's). ICT competency requirements are organized by professional level.
Portugal	Teacher training according to the Bologna Process. Existence of a dynamic reference framework for digital competence for Portugal, inspired by the EU's DigComp. Requirement of digital skills organized in the form of specific courses and transversally throughout the curriculum, covering programmatic contents and teaching methods.

Source: Adapted from Araripe and Lins (2020, p. 45).

In other words, it is necessary to understand how digital competencies are being developed in the initial teacher training because for Matos and Pedro (2010, p. 138):

> [...] this is a critical factor insofar as it is recognized that a significant percentage of elements of the educational community are not users of ICT in a natural way, not being integrated into their professional and personal practices.

In addition to the perception of digital competencies, it is necessary to understand the competencies that lead to the integration of technologies in the classroom, that is:

> [...] great effects should not be expected from technology, ignoring the pedagogical perspectives that underlie its use. Teachers will always have a key role, they will always be responsible for guiding the activities. Therefore, training needs cannot be overlooked. (PONTE, 1989, p. 47).

Pedro and Matos (2017, p. 225) understand "[...] teaching as a complex profession, which requires commitment, dedication and training [...]", making it necessary to have the view that it is "[...] essential to analyze competences based on the subject as a whole [...]" and, in this sense, beyond the professional, pedagogical, technological domains and interpersonal and institutional relationships, it is necessary to have a vision of how digital competencies are being developed in the initial teacher training, articulating pedagogical competencies for digital technologies insertion in the classroom (PEDRO; MATOS, 2017).

Based on the proposals of INCoDe.2030 and DigComp, we look at the curricular components of initial teacher training courses and, in this specific analysis, we checked how digital technologies appear in curricular structures. To this end, it is important to highlight that, in Portugal, initial teacher training complies with the Bologna Process,

which aims to balance the national systems of higher education in the countries that are part of the European space and, thus, guarantee comparability, compatibility, and coherence between education systems in Europe (MESQUITA; MACHADO, 2017).

In this sense, Mesquita and Machado (2017) highlight that, in Portugal, having a professional qualification is a condition for being a teacher, and the courses that professionally qualify for teaching are the Masters in Education (2nd Cycle).

Based on the parameters described in Table 1, the curricular components of the 12 Master's courses in Education at the Institute of Education of the University of Lisbon were analyzed, observing that only 16.66% of the courses have a specific curricular unit for the integration of digital technologies in the teaching-learning process, one of the courses is the master's degree in Education – Computer Science. Também se observa que apenas 33,34% dos cursos atendem de forma transversal, ou seja, com temas que tratam do assunto em seus conteúdos programáticos. It was also seen that 58.33% of the courses refer to digital technologies only in their teaching methods, not being evident in what way or which technologies can be used. It is noteworthy that one of the courses poorly meets the item, that is, 8.33%, as shown in Table 3.

Table 3 – Study plans of Institute of Education of the University of Lisbon

Master's degree	**Is there integration of digital technologies?**	
	Specific curricular unit	**Transversely in another curricular unit**
Education - Biology and Geology	No	Fully meets the parameters
Education - Mathematics	No	Partially meets the parameters
Education - Physics and Chemistry	No	Fully meets the parameters
Education - Geography	No	Partially meets the parameters
Education - History	No	Partially meets the parameters
Education - Philosophy	No	Partially meets the parameters
Education - Portuguese and Foreign Language	No	Partially meets the parameters
Education - English and Foreign Language	No	Partially meets the parameters
Education - Portuguese in the 3rd Cycle of Basic and Secondary Education and Latin in Secondary Education	No	Partially meets the parameters
Education - English in the 1st Cycle of Basic Education	No	Poorly meets the parameters
Education - Economics and Accounting	Yes	Fully meets the parameters
Education - Computer Science	Yes	Fully meets the parameters

Source: Authors' own (2022).

To carry out the analysis of the 12 Master's courses in Education at the Institute of Education of the University of Minho, the same parameters already referenced in the methodology of this work were used, that is, the analysis of the curricular units, their syllabus and their teaching methods.

Analyzing Table 4, it can be seen that 58.33% of the analyzed master's courses have a specific subject for the integration of digital technologies in education, and the master's courses aimed at early childhood education and 1st cycle education do not have the subject. Another important data is that 58.33% of the subjects explicitly described the use of digital technologies in a transversal way in their syllabus, and 8.33% partially address the subject, because, despite being proposed, its use and description in teaching methods are not clear. Another 25% of the courses poorly address the integration of "digital technologies" in their study plans. One of the courses does not meet the analysis criteria, which is equivalent to 8.33%.

Table 4 – Study plans of Institute of Education of the University of Minho

Master's degree	**Integration of digital technologies**	
	In a specific curricular unit	**Transversely in another curricular unit**
Early Childhood Education	No	Poorly
Early Childhood Education and 1st Cycle of Basic Education	No	Poorly
1st Cycle of Basic Education and Mathematics and Natural Sciences in the 2nd Cycle of Basic Education	No	Fully
1st Cycle of Basic Education and Portuguese and History and Geography of Portugal in the 2nd Cycle of Basic Education	No	Fully
English in the 1st Cycle of Basic Education	No	Fully
Biology and Geology in the 3rd Cycle of Basic Education and Secondary Education	Yes	Fully
History in the 3rd Cycle of Basic Education and Secondary Education	Yes	Poorly
Mathematics in the 3rd Cycle of Basic Education and Secondary Education	Yes	Fully
Portuguese in the 3rd Cycle of Basic Education and Secondary Education	Yes	Does not meet the parameters
Music	Yes	Partially
Computer Science	Yes	Fully
Physics and Chemistry in the 3rd Cycle of Basic Education and Secondary Education	Yes	Fully

Source: Authors' own (2022).

Analyzing Table 5, it can be seen that 37.5% of the Masters in Education of the Faculty of Social and Human Sciences linked to the Nova University Lisbon have a specific subject about the use of digital technologies in the teaching-learning process. Even though

there is a specific subject for digital technologies, it can be seen that 50% of the courses fully meet the parameter “there is a transversal integration of digital technologies in another curricular unit” meaning the use of digital technologies in the teaching-learning process appears clearly and objectively in the syllabus and, in this sense, the item in question is not met by 37.5% of the courses, and 12.5% poorly meet the parameters.

Table 5 – Study plans of the Faculty of Social Sciences and Humanities of Nova University Lisbon

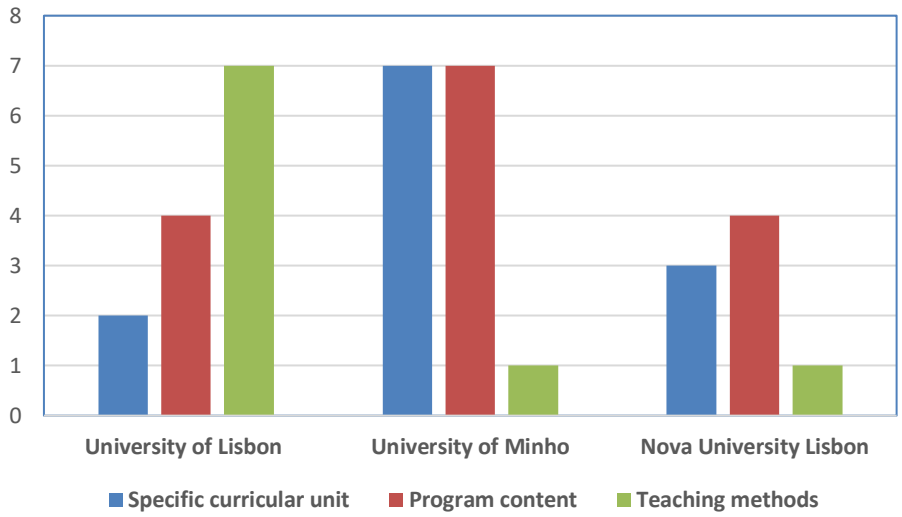
Master's degree	**Integration of digital technologies**	
	In a specific curricular unit	**Transversely in another curricular unit**
Music Education in Basic Education (2nd Cycle of Basic Education)	Yes	Does not meet the parameters
Philosophy in Secondary Education	No	Does not meet the parameters
Geography in the 3rd Cycle of Basic Education and Secondary Education	Yes	Does not meet the parameters
History in the 3rd Cycle of Basic Education and Secondary Education	No	Fully
English and Foreign Language in the 3rd Cycle of Basic Education and Secondary Education	No	Fully
English in the 3rd Cycle of Basic Education and Secondary Education	Yes	Fully
Portuguese and Foreign Language in the 3rd Cycle of Basic Education and Secondary Education	No	Fully
Portuguese in the 3rd cycle of Basic Education and Secondary Education	No	Poorly

Source: Authors’ own (2022).

4 Discussion

After the analysis and taking into account that the study considers only three institutions that have initial teacher training, it is noteworthy that the sample was 32 master's courses in different areas. In general, it is clear that the institutions analyzed in this study are concerned with the integration of digital technologies and the development of digital competencies in the initial teacher training. Such evidence can be verified by the Master's course in Computer Science by the Institutes of Education of the Universities of Lisbon and Minho, by the insertion in the curriculum of courses of specific subjects to promote and develop digital competencies, as well as by the transversal way in that digital skills are required throughout the syllabus and teaching methods.

Graph 1 – Course units with an indication of the use of digital technologies



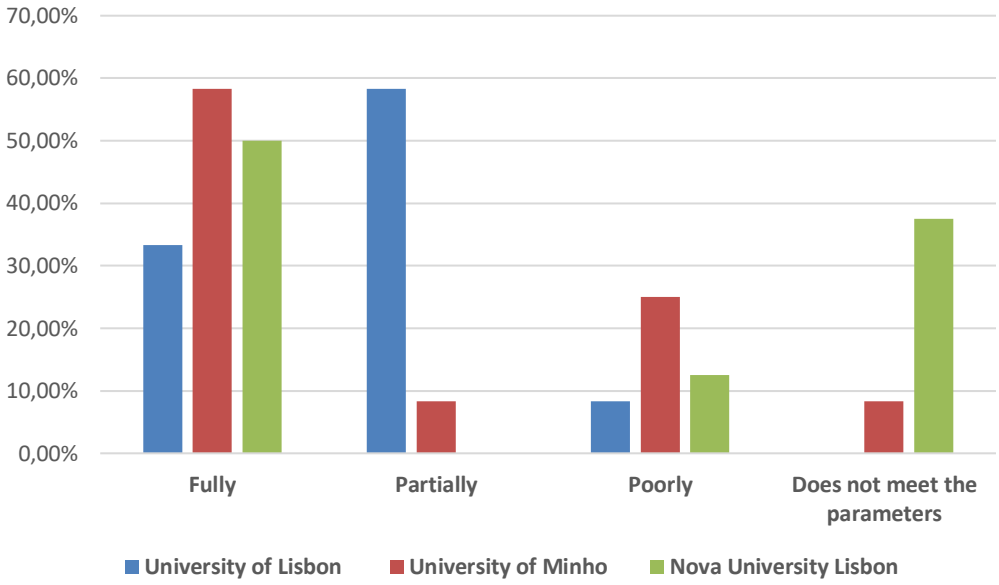
Source: Authors' own (2022).

When analyzing Graph 1, it can be seen that of the 12 courses of the Institute of Education of the University of Lisbon analyzed, only 16.67% offer a specific curricular unit to learn about digital technologies and their integration in the teaching-learning process. For this same item, the Faculty of Social and Human Sciences of Nova University Lisbon has 37.5%, out of a total of eight analyzed courses. The Institute of Education of the University of Minho has a specific subject entitled "Educational Technology", which is shared by 58.33% of the 12 courses investigated.

Regarding the presence of subjects related to digital technologies in the teaching-learning process in the syllabus of the curricular units of the investigated master's courses, it can be seen that 58.33% of the 12 courses analyzed of University of Minho offer such courses, including here the subject "Educational Technology". The Nova University Lisbon has 50% of the eight courses studied. With 33.33% of curricular units with subjects related to digital technologies, the University Lisbon has the lowest percentage concerning its 12 courses.

When analyzing the presence of digital technologies in the teaching methods of the curricular units, the University Lisbon has the best index in relation to its 12 studied courses, that is, 58.33%. University of Minho appears with only 8.33% of its 12 courses, and the Nova University Lisbon, with a slightly better index, 12.5%, in relation to its eight courses analyzed.

Graph 2 – Compliance with the parameters analyzed transversally



Source: Authors' own (2022).

Regarding compliance with the parameters analyzed transversally, as shown in Table 1, in the methodology, it is observed in Graph 2 that the best percentage of compliance (58.34%) is from University of Minho, followed by Nova University Lisbon (50%) and by University of Lisbon (33.34%). As for partial attendance, the University of Lisbon has the highest rate of subjects related to digital technologies in its teaching methods (58.33%), followed by University of Minho (8.33%) and the Nova University Lisbon (0%).

It is important to highlight that University of Minho has an index of 25% for the item "meets the parameters poorly" and that the Nova University Lisbon has an index of 37.5% for the item "does not meet the parameters", as can be seen in the Graph 2.

5 Final considerations

When verifying whether the analyzed curricular units, in a way, can meet what DigComp and QDRCD propose for Portugal, it can be noticed that the competencies required in these documents are being developed implicitly in academics throughout the training process. Meaning that information literacy is required, as scientific research and information filtering in the most diverse academic data repositories are mandatory. The use of academic control systems, as well as the need for collaborative work and

coexistence in virtual learning environments, strengthen communication and citizenship skills.

The writing of scientific and academic works, whether articles, dissertations, or theses, promotes skills for the creation of digital and scientific content. So, ensuring privacy, and the security of personal data, as well as understanding the impacts of digital technologies on society, is a long-discussed and relevant factor for the academia.

Therefore, when talking about initial teacher training, we talk about professional training, and, in this sense, in an increasingly digitalized world, teachers need to innovate, seek creative solutions for the teaching-learning process, as well as the ability to identify gaps in required digital skills.

The indices presented in Graphs 1 and 2 demonstrate that the different courses of initial teacher training of the three analyzed institutions have different strategies concerning the integration of digital technologies in the teaching-learning process. It is important to point out that, this study doesn't make a judgment on the strategies used by each course, but rather seeks to demonstrate the conditions that can lead future teachers to develop digital skills that can make the integration of digital technologies a reality in the classroom.

It was noticed, in the analysis, that the themes related to digital technologies, for the most part, are in the syllabus and teaching methods of subjects related to didactics, which, in a way, is following the literature on the theme (COSTA, 2008, 2012).

This study is not conclusive, but it points to the strategies that are being implemented in initial teacher training courses. These courses aim to develop digital skills that can allow future teachers to create the integration of digital technologies in the teaching-learning process.

Specific courses combined with practical and didactic subjects that address issues related to the use or integration of digital technologies in the classroom is possibly a good way to develop the digital skills necessary to meet what propose the requirements of this new reality that presents itself in response to the information and communication society.

Finally, the institutions analyzed clearly point to digital skills development that can provide future teachers with mastery and correct use of resources and the potential of technologies in student learning.

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