INTED 2022

16th International Technology, Education and Development Conference

7-8 March, 2022

CONFERENCE PROCEEDINGS

Sharing the Passion for Learning

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Sharing the Passion for Learning

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Luis Gómez Chova, *University of Valencia, Spain*
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Preface

INTED2022 Conference Proceedings contain selected and revised papers from the 16th International Technology, Education and Development Conference.

INTED2022 was held virtually on March 7th and 8th 2022. After 14 years as an "in-person" conference, the 2021 and 2022 editions were held on-line due to the COVID-19 restrictions.

Every year, INTED brings together lecturers and researchers from universities and educational institutions from all over the world. This edition counted with 1264 participants from more than 75 different countries, ensuring a geographic diversity and a multicultural environment.

The main objective of INTED2022 was to offer a meeting point for educational experts to share and discuss their experiences and projects on education, learning and teaching technologies and educational Innovations. The conference program also provided different networking activities where participants could interact with other delegates and share their perspectives on education. In addition to the Technical Program, different plenary sessions with speeches, workshops and discussion panels were delivered by world-leading keynote speakers (keynote speeches available at IATED Talks, https://iated.org/talks/).

The scope of INTED2022 included the following topics: Digital & Distance Learning, Digital Transformation of Education, Innovative Educational Technologies, Inclusion and Multiculturality, Active and Student-Centered Learning, Assessment, Mentoring & Student Support, Educational Stages and Life-Long Learning, Quality & Impact of Education, Teacher Training and Educational. Management, STEM Education, Discipline-Oriented Sessions, Language Learning and Teaching, Innovative Educational Technologies.

The INTED2022 International Program Committee is composed of lecturers and researchers from all over the world. A meticulous job in selecting papers for publication was conducted. We wish to thank the program committee members who conducted a blind peer review process to guarantee the quality of the contributions and presentations. The following points were evaluated: information content, general structure, clarity, relevance, originality, relation to the conference topics and disciplines. The language of the publication was exclusively English.

Moreover, INTED2022 aims to publish conference proceedings that contain original research articles of high-quality meeting the expected ethical standards. Authors publishing in INTED2022 signed the IATED copyright transfer form. IATED guarantees the high technical and professional quality of the publications, and that good practice and ethical standards are maintained. More information about the publication ethics is available at: https://iated.org/publication_ethics

Finally, we wish to extend our most sincere thanks to all members and delegates who contributed to these INTED2022 Proceedings. We hope that readers will find this volume inspiring and look forward to the continuation of the INTED series in the coming years.

Luis Gómez Chova
Agustín López Martínez
Ignacio Candel Torres

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SELF-PERCEPTION OF DIGITAL COMPETENCE OF TEACHERS IN BASIC AND SECONDARY EDUCATION IN CAPE VERDE

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Abstract

This study is based on an investigation into the teacher's self-perception of digital competence in Basic and Secondary Education in Cape Verde, developed during the Master's degree course in ICT in Education and Training at the School of Education of the Polytechnic Institute of Bragança, Portugal. As its goals, the study sought to (i) verify the infrastructure conditions of schools in Cape Verde for the pedagogical use of digital technologies; (ii) analyse the self-perception of basic and secondary education teachers in Cape Verde concerning the area of digital skills. For this study, we took as a reference the *Marco Común de Competencia Digital Docente* [1], created by the INTEF (*Instituto Nacional de Tecnologías Educativas y Formación del Profesorado*) from Spain, whose objective is to offer a descriptive reference of digital competence for training purposes and to serve in the processes of teacher assessment and accreditation. The choice for this framework is justified because we consider it to be up to date and based on the European framework [2][3]. For data collection, we used an electronic questionnaire based on Marco Común's five areas of digital competence: (i) Information and information literacy; (ii) Communication and collaboration; (iii) Creation of digital content; (iv) Security; (v) Problem Resolution. Competences were categorized into six progressive levels of competence: A1 and A2 - Basic Level; B1 and B2 - Intermediate level; C1 and C2 - Advanced level, according to the same reference. First, the questionnaire was validated by four Ph. D. professors and researchers from higher education and twelve teachers with similar characteristics to the research participants. The methodology adopted was descriptive content analysis, based on the questionnaire that was distributed using the snowball technique. A return of 212 responses was obtained. For data analysis, descriptive statistics were used with percentage values in the form of bar graphs and tables. The results indicate that, regarding the conditions of infrastructure, computer equipment and internet connection, teachers consider that schools in Cape Verde are not sufficiently equipped for a pedagogical use of digital technologies. As for digital competence, we found that teachers' self-perception varies from basic (A1 and A2) to intermediate (B1 and B2) levels. The results also indicate a clear perception, on the part of teachers, regarding the importance of digital technologies for pedagogical work in the learning process and education.

Keywords: Digital teacher competence, digital technologies, school infrastructure, competences benchmark, Cape Verde.

1 INTRODUCTION

The 2030 Agenda organized in 2015 by the UN (United Nations), presents a set of 17 SDGs (Sustainable Development Goals), 169 targets and 230 indicators, which outline an action plan, in the medium and long term, with concrete goals in various areas, from education and health to gender equality, justice and peace. Social development on the planet is associated with problems of different natures, from climate change, inequality, social injustice, and extreme poverty of the vulnerable population. According to data from the United Nations Educational, Scientific and Technological Organization [4] 91% of children in developing countries were enrolled in basic education, however, there were still 57 million children out of school, and more than half of this number were children from African countries.

In this context, the "Goal 4: Quality Education" of the United Nations 2030 Agenda presents a set of goals that aim to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Therefore, almost six years later, there are still many challenges to be overcome to ensure this goal, from the social problems of conflict and poverty to the problems of lack of infrastructure for the digital society and the lack of training of education professionals.

The teacher, as the promoter of the development of future citizens of today's society [5] [6] [7] [8], plays a key role in the promotion of quality education. Therefore, the need emerges for public policies aimed at the initial and continuing training of teachers for the development of teacher training in digital skills.

In times of accelerated innovation and omnipresent technology, which transforms relationships in the most diverse sectors, promoting the development of a digital society and economy, there is a pressing need to provide individuals with digital skills, promoting their adaptation, employability, social inclusion and integration into a complex and constantly changing world.

We have then, a great challenge for education: the continuous training of the teaching professional for the development of skills promoting the pedagogical integration of technologies to educational contexts [7] [8] [1][9][10].

In line with this challenge, this paper aims to present the results of a study developed during the Master's degree course in ICT in Education and Training at the School of Education of the Polytechnic Institute of Bragança [11]. As an objective, the study sought to: (i) verify the infrastructure conditions of schools in Cape Verde for the pedagogical use of digital technologies; (ii) analyse the self-perception of primary and secondary teachers in Cape Verde regarding the mastery of digital skills.

The methodology adopted was descriptive content analysis [12], based on an electronic questionnaire, distributed according to the snowball technique. The questionnaire was designed based on the competency structure of the *Common Framework* for *Digital Teaching Competency* (*Marco Común de Competencia Digital Docente)* [1]. The choice of this framework is justified because we consider it to be current and based on the European frameworks[2] [3]*,* but more specified in terms of competences. A total of 212 teachers participated in this study.

2 AREAS OF COMPETENCE AND THE COMMON FRAMEWORK FOR DIGITAL TEACHER COMPETENCE

Since the end of the 1990s, many studies and research have focused on issues that permeate the training of citizens and professionals to live and produce well in a world of constant change. Among the many theoretical perspectives that discuss which are the necessary skills, today, all converge on the same common point: the requirement for new skills for current professionals to be prepared for a constant transformation of the profession. The same occurs in the educational universe, especially for the teaching profession. Teachers must be empowered with digital competences to develop them in students.

Awareness of the need to develop teachers' digital competences has led many countries to develop teacher training policies to enable them to use digital technologies in learning and training contexts. Practically all Western countries (or regions) have developed projects in the context of teacher training in digital competence. It is in this context that the benchmarks of teacher digital competence emerge.

The digital competences benchmarks translate studies and research that are being carried out since the first decade of the 21st century, a period in which learning mediated by digital technologies involves more than just the use of technologies in the classroom; it requires a paradigm shift committed to the development of skills and student learning, aimed at creating an innovative educational environment, capable of training citizens prepared for the new social and professional demands of this century.

In this study, we first analysed three benchmarks of digital teacher competences developed by (i) European Union, [3]; (ii) UNESCO, [8]; (iii) INTEF Spain, *Marco Común de Competencia Digital Docente* [1]. After this analysis, we availed ourselves of the Spanish framework to guide our research, as it is a framework where the competency framework is well specified. The investigations and research that make up this benchmark began in 2012 with the aim of providing a descriptive reference of digital competences that can be used for training purposes and in teacher assessment and accreditation processes. The document was built over the years with five versions published since 2013. The latest version dates from 2017, which aligns the competence descriptors with those of the "European Digital Competence Framework" - DigCompEdu [3]. The Spanish benchmark sought to detail the digital competences of teachers for the 21st century to improve their educational practice and professional development. It is divided into five interrelated skill areas (Fig. 1).

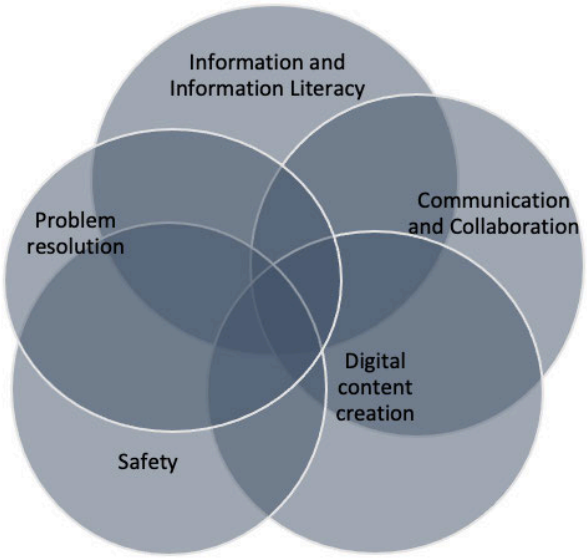

Figure 1. Areas do Marco Común de Competencia Digital Docente [1] (p. 13)

There are twenty-one competences that make up these areas, divided into six progressive levels of competence: A1 and A2 - Basic Level; B1 and B2 - Intermediate Level; C1 and C2 - Advanced Level. The document presents in detail each of the twenty-one competences in their respective areas, with descriptors based on knowledge, skills and attitudes. This structure was thus designed to identify the teacher's level of competence, creating a progressive and autonomous development plan which starts at basic A1 level up to the maximum advanced C2 level. This framework is useful both for the training process and for the assessment and accreditation process of teacher digital competences (Table 1).

Table 1. Digital Competences according to the Marco Común de Competencia Digital Docente [1] (p. 2)

Competence Areas	***Competences***	***Levels***
Area 1. Information and informational literacy	1.1. Navigation, searching and filtering information, data and digital content 1.2. Assessment information, data and digital content 1.3. Storage and retrieval of information, data and digital content	6 levels of competence for each of the 21 competences that make up the reference tool.
Area 2. Communication and Collaboration	2.1. Interaction through digital technologies 2.2. Sharing information and digital content 2.3. Citizen participation online 2.4. Collaboration through digital channels 2.5. Netiquette 2.6. Digital Identity Management	
Area 3. Digital content creation	3.1. Development of digital content 3.2. Integration and rework of digital content 3.3. Copyright and License 3.4. Programming	
Area 4. Security	4.1. Device protection 4.2. Personal data protection and digital identity 4.3. Health protection 4.4. Environmental protection	
Area 5. Problems Solutions	5.1. Technical troubleshooting 5.2. Identification of technological needs and responses 5.3. Innovation and use of digital technology in a creative way 5.4. Identification of digital competence gaps	

For the investigation of this research, we took the areas of digital competence as a basis, according to the *Common Framework for Teacher Digital Competence [1]*: (i) Information processing; (ii) Communication; (iii) Content creation; (iv) Security; (v) Problem solving, as we consider this benchmark to be the most current and based on the European benchmark, *DigCompEdu [3]*.

3 METHODOLOGY

This study is based on an investigation on the self-perception of digital competence of primary and secondary school teachers in Cape Verde, developed during the Master's degree course in ICT in Education and Training at the School of Education of the Polytechnic Institute of Bragança [11] and had the following objectives: (i) to verify the infrastructure conditions of schools in Cape Verde for the pedagogical use of digital technologies; (ii) to analyse the self-perception of primary and secondary teachers in Cape Verde regarding the mastery of digital competences. The research was based on the document *Marco Común de Competencia Digital Docente* [1], created by the INTEF of Spain.

The methodology adopted was descriptive content analysis [13] [14], based on an electronic questionnaire distributed to teachers of Basic and Secondary Education in Cape Verde. The questionnaire was created in the Google Forms application, in which 73 questions were designed according to the research objectives. The questionnaire was disseminated through the *Snowball* sampling technique that uses reference chains, a kind of network, according to Baldin and Munhoz [15]. Thus, the questionnaire was sent to the teachers by electronic mail, by the teachers' group on *Facebook* social networks and on the *Messenger* application, so that they could answer and spread to their fellow teachers, with the intention of reaching the maximum number of respondents.

The questionnaire was organised in the five digital competence areas of the *Common Framework*: (i) Information and information literacy; (ii) Communication and collaboration; (iii) Creation of digital content; (iv) Security; (v) Problem solving. The competences were categorized into six progressive levels of competence: A1 and A2 - Basic Level; B1 and B2 - Intermediate Level; C1 and C2 - Advanced Level, according to this framework and had five sections distributed between (I) Identification of respondents; (II) Training and use of information and communication technologies (ICT); (III) Infrastructures for the pedagogical use of ICT in school; (IV) Usability of ICT in Education; (V) Identification of competences by category. The questions follow a closed structure with alternative selection or based on the scale of progressive levels of competence.

First, the questionnaire was validated by 4 higher education teachers with research in digital competence and 12 teachers with similar characteristics to the target audience. Some adjustments were made, according to the feedback from this evaluation, before sending the questionnaire to Cape Verdean teachers.

The respondents of this study had their identification, data protection and reliability rights safeguarded, and the term "Informed Consent" was made available at the beginning of the questionnaire. A total of 212 primary and secondary school teachers from Cape Verde participated in this study.

4 ANALYSIS AND DISCUSSION OF RESULTS

For this study, we cut out Pina's complete research [11] to deepen our studies on the infrastructure conditions of schools in Cape Verde for the pedagogical use of digital technologies and the correlation between teachers' self-perception regarding the mastery of digital competences. For data analysis, the research objectives were categorised using the questions in the questionnaire with a view to organising and summarising the data in such a way as to provide answers to the proposed research problem [16]. Descriptive statistics with percentage values were used in the presentation of data in the form of bar charts and tables.

Teachers' digital competence was checked in the 5 areas, according to the Spanish benchmark. For each of the five competency areas, we based our work on previous research [17] by categorizing the answers on a Likert-style scale, with intensity between (1) Never to (6) Always do/use, for each of the competency descriptors that were organized according to the progression of the six levels of competences in the Spanish *Common Framework* benchmark (Fig. 2).

Competence levels of the Common Digital Competence Framework for Teachers		
Basic	A1	This person has a basic level of competence and requires support in order to develop their digital competence.
	A2	This person has a basic level of competence, although with a certain level of autonomy and with appropriate support, they can develop their digital competence.
Intermediate	B1	This person has an intermediate level of competence, so, on their own and by solving simple problems, they can develop their digital competence.
	B2	This person has an intermediate level of competence, so that, independently, responding to their needs and solving well-defined problems, they can develop their digital competence.
Advanced	C1	This person has an advanced level of competence, so they can guide other people to develop their digital competence.
	C2	This person has an advanced level of competence, so, by responding to their needs and those of other people, they can develop their digital competence in complex contexts.

Figure 2. Marco Común de Competencia Digital Docente: levels of competence [1] (p. 4)

Regarding the infrastructure conditions of schools in Cape Verde for the pedagogical use of ICT in schools (Table 2), the data collected reveals the need for greater investment in digital equipment, with 73.5% of teachers disagreeing that in their school there is computer equipment in classrooms. Regarding the quality of the internet network, it was found that 41.5% of teachers disagree that in their school there is good quality internet, against 22.6% who agree. As for students' access to the Internet, the data revealed that only 16.5% of teachers agree with the statement, compared to 60.9% who disagree. In relation to network coverage in school spaces, 44.4% of teachers agree that in their schools there is internet only in some spaces, against 33.3% who disagree. It can be inferred that this result is related to the network structure available in schools, data obtained in questions 3 and 4 in which 40.6% of teachers claim to have WiFi network in their schools against 34.5% who claim to have only wired network in their schools.

Table 2. Infrastructure for the pedagogical use of ICT in schools

Questions	***Answers in % according to scale 1 – I totally disagree to 6 – I totally agree***					
	1	***2***	***3***	***4***	***5***	***6***
1. My school has good quality internet.	**26,4**	**15,1**	18,4	17,5	11,3	11,3
2. In my school there is computer equipment in the classrooms.	**53,7**	**19,8**	5,7	8,5	3,8	8,5
3. At my school there is only wired internet.	30	13,7	8,5	13,3	**17,5**	**17**
4. At my school there is wireless internet (Wi Fi).	37,7	4,7	10,4	6,6	**8,5**	**32,1**
5. Students at the school have Internet.	**43,9**	**17**	12,7	9,9	6,6	9,9
6. In my school there is only internet in some places.	24,1	9	11,2	11,3	**7,1**	**37,3**

About teachers' self-perception of the mastery of digital competences, we found that in relation to the competences associated with "Information Processing" and "Communication", areas 1 and 2, teachers presented intermediate competences at levels B1 and B2. In relation to area 3 "Content Creation", we found that teachers' competences are at Basic to Intermediate levels, with significant numbers ranging from level A1 to B2. As for area 4 "Digital Security", it was observed that teachers are at levels B1 and

B2 and, in area 5 "Problem solving", we have a transition of competence level between Basic and Intermediate, with teachers at levels A2 and B1 (Table 3).

Table 3. Categorisation of the digital competences of the research participants

Category	Competence Levels %					
	1	2	3	4	5	6
	Basic (A1 and A2)		Intermediate (B1 and B2)		Advanced (C1 and C2)	
1. Information	16	15,1	18,4	19,8	11,8	18,9
2. Communication	9,4	15,6	19,8	22,6	15,6	17
3. Digital content creation	22,2	19,4	21,2	19,3	11,3	6,6
4. Security	16	16,5	18,9	18,9	13,7	16
5. Problems Solutions	19,3	21,8	19,3	18,4	10,4	10,8

Another result that we considered relevant for sharing in this study was in relation to a clear perception by teachers of the importance of digital technologies for pedagogical work in the learning process and in education in general. This verification can be seen in the answers to the questions in section (IV) Usability of ICT in Education, which we consider to be relevant in the sharing of this study (Fig. 3).

Usability of ICT in Education	Levels of perception by teachers %					
	1	2	3	4	5	6
4.1. I believe that technologies are useful for pedagogical work.	0,5	0,5	2,4	3,3	13,2	**80,1**
4.2. I believe that technologies facilitate pedagogical work.	0,5	0,5	0,5	3,3	13,7	**81,5**
4.3. I believe that educational work combined with the use of technologies contribute to learning.	0,5	0	0,5	2,8	13,2	**83**
4.4. I believe that I find it easy to use technologies in my classes.	8	5,7	13,2	12,3	21,7	**39,1**
4.5. I believe I have the necessary knowledge to use technologies in my classes.	3,3	2	9,4	14,6	27,8	**42,9**

Figure 3. Participants' perception of the use of technology in education

It was also found that, when asked about having the facility and knowledge necessary to know how to use ICT, questions 4 and 5, there was a significant drop in the number of teachers who perceived themselves at levels C1 and C2, compared to the answers obtained in questions 1 to 3 of this section.

5 CONCLUSIONS

This study sought to verify the infrastructural conditions of schools in Cape Verde for the pedagogical use of ICTs and to analyse the self-perception of primary and secondary teachers in Cape Verde regarding the mastery of digital competences. The results indicate that, regarding the infrastructure conditions, computer equipment and Internet connection, teachers consider that schools in Cape Verde are not sufficiently equipped for the pedagogical use of ICT. Regarding digital competences, we found that teachers' self-perceptions range from basic (A1 and A2) to intermediate (B1 and B2) levels.

Regarding the use of ICT for pedagogical work in the learning process and in education in general, we found that there is a clear perception, by teachers about its importance, which leads us to infer about the importance of continuous training to empower teachers to develop their competences.

As a limiting factor for this study, we identify the fact that the data analysed come from a single source, an electronic questionnaire answered by teachers, a fact resulting from the Covid-19 pandemic situation that prevented from being observed *in loco*, the infrastructure and digital resources existing in schools to verify the conditions that teachers and students have to use ICT for pedagogical purposes in schools. Another limiting factor is the fact that the verification of competences was based on perception by teachers, which may lead to some deviation depending on how teachers self-perceive.

The relevance of this study is based on the context of the digital society that poses a major challenge for education: the continuous training of the teaching professional for the development of skills promoting the pedagogical integration of technologies to educational contexts [7] [8] [1] [9] [10].

The results obtained can contribute to the scientific-academic knowledge necessary for greater awareness of the emergence of the development of teachers' digital competence, the importance of providing a quality infrastructure for the use of ICT in Cape Verdean schools and to guide future projects and public policies in Cape Verde to improve education.

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