Incorporation of ICT into preservice teacher training using the Flipped Classroom so as to enhance inclusive education

Incorporación de las TIC en la formación inicial del profesorado mediante Flipped Classroom para potenciar la educación inclusiva

iD Ana Cristina Blasco-Serrano; anablas@unizar.es

iD Irene Bitrián González; ibitrian@unizar.es

iD Teresa Coma-Roselló; tcoma@unizar.es

University of Zaragoza (Spain)

Abstract

The pedagogical application of Information and Communication Technology (ICT) is an important challenge facing education today. In this paper, ICT is integrated into higher education courses using the Flipped Classroom (FC) strategy. Students learn theory at home through online tutorials prior to practical work in class based on the theory. They can also assess their own performance using the Audience Response System (ARS). The aim is to find out more about the inclusion of technology in teacher-training on the basis of the TPCK models, using FC and ARS. Using a mixed (qualitative and quantitative) approach, 134 students of Primary Teacher Training and a Professional Diploma course took part in an ad hoc survey. The results show the importance of active learning, the value of the pre-class tutorials and the quality of their design. Another advantage was that students could receive feedback during the learning process. The data indicates that this methodology enhances attention to diversity, improving understanding and allowing students to learn at their own pace.

The results highlight the need for teachers to receive pedagogical, technological and content training to improve their digital skills during preservice higher education.

Keywords: TPCK model, Flipped Classroom, pre-service teacher training, digital competence teachers', inclusive education

Resumen

La aplicación pedagógica de la Tecnología de la Información y la Comunicación (TIC) es un importante desafío al que se enfrenta la educación. En este artículo, las TIC se integran en los cursos de educación superior utilizando la estrategia Flipped Classroom (FC). Los estudiantes aprenden la teoría en casa a través de tutoriales online previo al trabajo práctico en clase basado en la teoría. También pueden evaluar su propio desempeño utilizando el Sistema de Respuesta de Audiencia (ARS). El objetivo es profundizar en la inclusión de la tecnología en la formación docente a partir de los modelos TPCK, utilizando FC y ARS. Con un enfoque mixto, 134 estudiantes de Magisterio de Primaria y Diplomatura Profesional participaron en una encuesta ad hoc. Los resultados muestran la importancia del aprendizaje activo, las tutorías previas a la clase y la calidad de su diseño. Otra ventaja consiste en la retroalimentación durante el proceso de aprendizaje. Los datos indican.

Los resultados destacan que esta metodología favorece la atención a la diversidad, mejora la comprensión, permite diferentes ritmos de aprendizaje. Asimismo, muestra la necesidad de que los docentes reciban formación pedagógica, tecnológica y de contenidos para mejorar sus competencias digitales en la educación superior inicial.

Palabras clave: TPCK, Flipped Classroom, formación inicial docente, competencia digital docente, educación inclusiva

---

Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

1. INTRODUCTION

1.1. The challenge facing teachers

In the last few decades, and especially recently during the COVID-19 pandemic, digital technology has played an active role in the progress of society and in people's lives. As might be expected, it has also acquired a leading role in teaching practice and is transforming the teaching-learning paradigm at great speed (Sancho-Gil, 2019; Suárez Guerrero et al., 2020). Technology is emerging from this process as a highly versatile tool for enhancing teaching and learning processes (Fuentes et al., 2019). The inclusion of technology in teaching-learning processes has given rise to new, ubiquitous learning environments with a new formula for learning, in which students can learn and interact anywhere and at any time through a wide range of different devices (Blasco et al., 2016, 2018; Engen, 2019).

One of the big challenges facing teachers who want to make pedagogical work in the classroom more dynamic is to successfully combine pedagogical and knowledge contents with technological input. In this sense, the Technological Pedagogical Content Knowledge (TPCK), model proposed by Mishra and Koehler (2006) and improved by Janssen and colleagues (2019) offers a framework that enables us to analyse the key elements required for integrating technology into teaching practice in a specific context. These authors emphasize the complex connections between content, pedagogy and technology. According to this model, good teaching practice must be based on achieving the right relationship between content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK), and a range of different research studies have corroborated the interdependence of these elements when it comes to efficiently incorporating technology into teaching practice (Pamuk et al., 2015). The effectiveness of courses to encourage teachers to include technology depend on the medium, planning, organization and design of the course (Long et al., 2016). This technology must be integrated into the classroom and into school in general within the framework of an inclusive education for all, in order to reduce educational and social gaps. The ultimate aim should be educational development rather than just consumption of technology (González et al., 2021; Sancho-Gil, 2019; Suárez et al., 2020). Teachers need to increase their knowledge and experience of ICT and its numerous applications in education so as to enable them to integrate it effectively into their classroom work (Sancho-Gil, 2019).

ICT facilitates inclusive education (Rose & Meyer, 2002; Torrecilla & García, 2020) in that it is enormously versatile when it comes to presenting information in different ways or in different formats. It also offers a range of options for the organization and selection of contents and enables teachers to create new transversal connections between different knowledge items. In other words, it offers the teacher much more flexibility in terms of presentation formats and teaching methods (Blasco-Serrano & Dieste, 2021). The inclusion of ICT in teaching/learning processes may require changes in the way teachers organize their work and in their general teaching culture (García, 2021; Vigo, 2021). In this sense, technology can be a powerful medium for enhancing participation and improving the response to the particular characteristics and needs of the students (Cabero & Valencia, 2019; Colás et al., 2019; Engel & Coll, 2021).

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

This study is framed within a constructivist perspective and focuses on the preservice training of teachers in the use of digital media. The aim is to help teachers to provide high-quality inclusive education that, supports and enhances the learning processes of all students (Mauri et al., 2016). This approach assumes some previous experience and views the teacher as a facilitator and the students as the agents of their own learning within a collaborative, inclusive framework (Blasco-Serrano et al., 2018).

1.2. Flipped Classroom

In a context in which ICT is beginning to take the place of textbooks, various alternative educational strategies have emerged including the "Flipped Classroom" (Bergmann & Sams, 2012), a method that combines the ubiquitous environment with in-class teaching in school.

In the Flipped Classroom model, ICT is used to enable students to receive, for example at home, the information they need to perform a series of practical tasks, which they then have to carry out in the classroom (DeLozier & Rhodes, 2017). In this way, the students build on their ability for independent learning, using the in-class time to apply the concepts they have been studying at home, while developing the required skills for this form of learning with the guidance and support of teachers (Blasco-Serrano et al., 2016). In the in-class sessions the students are given time to carry out their tasks and to share, discuss and clarify any doubts they may have with their peers (Abeysekera & Dawson, 2015; Perdomo, 2016). The use of video tutorials allows each student to review the information and the concepts they will have to apply as many times as necessary, as they can stop the video and consult teachers (or other videos) about any doubts they may have as they arise, allowing each student to learn at his or her own pace with attention and engagement (Blasco et al., 2016). To this end, the materials that the students must visualize prior to the class must be carefully planned and designed to meet the learning objectives (Haghighi et al., 2019).

According to the TPCK model, the inclusion of ICT in teaching and learning processes must be accompanied by a knowledge of ICT, an understanding of what it is and what it is for and of its possible connections with and usefulness in social and learning processes. Learning is articulated through participation, dialogue and collaboration and of interaction between teachers and students (DeLozier & Rhodes, 2017; Perdomo, 2016). Teachers therefore have to observe carefully, assess the information and provide feedback, advice and guidance to the students (Sohrabi & Iraj, 2016).

Educational practice must be planned in accordance with a flexible, open curriculum and in line with Design Inclusive Learning (Baldiris et al., 2016; Sánchez et al., 2018), in order to personalize teaching to suit the particular characteristics of each group and the diverse of the students (Azorín et al., 2019). The Flipped Classroom methodology allows teachers to customize the tasks and activities in order to adapt them to the particular needs of the students, so enhancing individual and collaborative work (Perdomo, 2016) and personalized and individualized teaching (Mauri et al., 2016). The incorporation of innovative practices, using technology and the Flipped Classroom as a didactic resource, allows teachers to include activities with different levels of detail or depth and to organize the learning materials more effectively (Sánchez et al., 2018). Flipped Classroom allows them to present the information in audio and video as well as on paper and select contents according to students' needs. It

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250

Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

also provides more flexibility as regards the best use of classroom time (Torrecilla & García, 2020). In Flipped Classroom, the students do practical exercises in class on the basis of the theory learnt by watching online video-tutorials at home. Through this process and the self-assessment using Audience Response System (ARS), the students learn both from their mistakes and by establishing new links between different learning items. The guidance and monitoring of the teaching process enables teachers to adapt learning situations on the basis of the needs, characteristics and interests of the students.

With these models and approaches in mind, this study seeks to find out more about the inclusion of ICT in education using the Flipped Classroom (FC) method, together with an Audience Response System (ARS) such as Kahoot or Mentimeter, and how this might improve teaching and learning processes. It focuses particularly on the need to attend to the full diversity of the whole student body and to develop teachers' digital skills.

2. MATERIALS AND METHODS

This research is based on a mixed methodological approach involving complementary, overlapping, qualitative and quantitative methods. Like all researchers, we use the paradigms that provide the best answers to our questions. In this mixed approach, the quantitative and qualitative methodologies applied at different times during the course of this research together form a solid framework within which to analyse new methods in education, a field that can be assessed both quantitatively and qualitatively (Tashakkori & Teddlie, 2003). Our research had the following objectives:

a) Find out what future educators think about the inclusion of Flipped Classroom and the Audience Response System (ARS) in teaching practice on the basis of the TPCK model.

b) Study how ICT training using the FC methodological strategy and ARS can encourage positive attitudes regarding the incorporation of ICT into teaching practice as a means of enhancing inclusive education.

2.1. Participants

A total of 134 students took part in the study. All the students were currently enrolled on a Teaching Training course, of which 110 were studying the first year of the degree course in Primary Teacher Training, which included a subject called "Educational Technology". The other 24 participants were pre-service teachers from two different years of the Professional Diploma course in Social and Educational Inclusion of Disabled People. Of the 134 students that took part in our study, the vast majority were female (73.7%). Most were aged between 18 and 25 (74.5%). The other students were aged between 25 and 35 (6.1%); between 35 and 45 (7.1%) and between 45 and 59 (13.1%). We also assessed the students from the different courses in separate groups before comparing them to try to find out if there were any differences between them. The other participants, who took part in the interviews, included two vocational counsellors from the training centre where the Professional Diploma was held and a trainee teacher.

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

All participants provided informed consent for their participation in this research, in compliance with the ethical criteria governing educational research.

2.2. Research context

The study was carried out between 2018 and 2019 and involved two teachers. The participation of the university students involved four hours a week of "Educational Technology" classes over four months during academic year 2018-2019. The Professional Diploma course lasted for 6 weeks, with ten hours training per week and was held at an Education Training Centre belonging to the Regional Government of Aragón (Spain) in 2019. The objective of these training courses was to develop teachers' digital skills and their knowledge of digital applications for the design of conceptual maps, video recording and editing, socio-constructivist games, the creation of multimedia presentations and resources and the use of social networks. The general aim of the courses was therefore to develop the students' digital teaching skills, so as to enable them to include ICT in their teaching practice with a view to covering the whole diversity of needs within the class.

As part of this training, the students watched various tutorials (available on *Youtube*) at home. After watching these tutorials, the in-class session was devoted to problem solving and doing tasks proposed by the teachers. In the last few minutes of these classes, the students took part in assessed activities using ARS, above all *KAHOOT* and *Mentimeter*, which enabled continuous, formative assessment of the students' learning process (Hunsu et al., 2016). The students also had to create a learning portfolio in which they reflected on their progress in terms of Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK) and Pedagogical Content Knowldge (PCK).

2.3. Data collection and analysis tools

For the collection of the quantitative data, we designed an *ad hoc* self-administered questionnaire, whose content validity was studied by a panel of seven experts. The Cronbach's Alpha value was calculated as a means of assessing the reliability of the questionnaire with a result of .825.

The questionnaire had 16 questions (table 1): 3 about personal details (gender, age and academic year), 12 closed questions (with Likert scale options) and 1 open-ended question. In closed questions 1 - 11, the respondents had to choose between: "strongly disagree/ disagree/ agree/ strongly agree". In question 12, they were offered the following options: "Improves performance and can be done more quickly / Involves more work for the same performance / Worsens performance but is quicker/ Improves performance but is slower". In the open-ended question 13 the preservice teachers were asked to freely express their opinions about Flipped Classroom and ARS in detail (qualitative aspect).

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250

Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

Table 1

Questionnaire questions

Personal details	Gender
	Age
	Academic year
Closed questions (with Likert scale options)	1. Watching the video-tutorials prior to the class enabled me to achieve the desired learning more efficiently.
	2. The material for the video-tutorials was correctly designed, well-structured and clearly defined.
	3. It is not necessary to provide video-tutorials to achieve the practical learning in class that we are seeking to achieve.
	4. Doing the multiple-choice questionnaires online after watching the video-lesson enabled me to achieve the in-class learning objectives more efficiently.
	5. The doubts that arose before and during the classes were properly dealt with and resolved.
	6. Classes of this kind have been useful for my professional training as a future teacher.
	7. Classes with video-tutorials facilitate learning more than classes without video-tutorials.
	8. Classes without video-tutorials facilitate learning more than classes with video-tutorials.
	9. The contents of the classes have met my professional development needs in terms of improving my digital skills for my future as a teacher.
	10. The questionnaires conducted after the practical in-class sessions facilitated and consolidated the learning process.
	11. Watching videos makes it easier for each person to learn at their own pace.
	12. As regards my performance, I believe that watching videos …
Open-ended question	13. Please express your opinion as to how watching video tutorials and using Audience Response Systems (ARS) influences teaching and learning processes.

These questions focused in particular on four core aspects of interest: use of ICT, Ease of use, Attitude and expectations and Intention to use. The *GoogleForms* tool was used to prepare the questionnaire. At the end of the ICT training session the students were given a link to the website so that they could complete the questionnaire anonymously. Participation was voluntary.

The statistical analysis of the responses to the questionnaires was conducted using the IBM SPSS Statistics 22 software. The independent samples T-test was used to compare the averages for the groups based on sex and type of course. The bivariate correlation between the variables was analysed using the Pearson correlation coefficient.

On the basis of the information obtained from the questionnaires and in order to gain a deeper understanding of the attitudes and perceptions of the future teachers, one semi-

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250

Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

structured interview was conducted with one student, and one semi-structured group interview was conducted with the end of the ICT training course. The first interview was with two counsellors from the Diploma course. We also held a focus group (FG) made up of eight students (six women - A,C,D,F,G,H- and two men –B,E-) and a teacher who was doing his teaching practice. Both interviews and the focus group were structured around open questions about the following issues: knowledge, previous expectations and attitudes, the use of ICT for teaching-learning processes taking into account the diversity within the class, and their intention to use ICT in their future professional lives as teachers.

On the basis of the information obtained in the interviews, the focus group and the open question in the questionnaire, we then performed a thematic analysis (Braun & Clarke, 2014). This involved structuring and allocating meaning to it. A number of initial categories emerged which later evolved slightly after being contrasted with previous research and with the TPCK variables. In this way the definitive categories emerged as a result of systematic analysis of the information.

This approach gives the study a high degree of credibility due to triangulation between the sources of information and between the information collection methods.
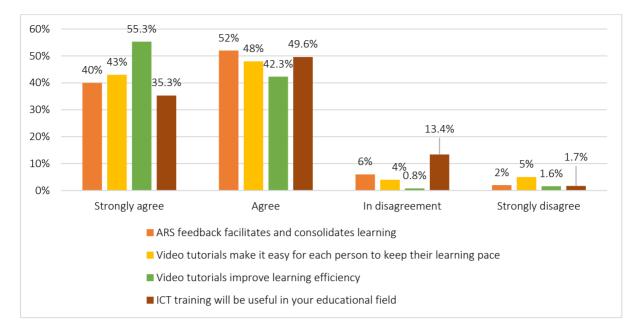
3. RESULTS

The statistical analysis of the data obtained from the questionnaire did not show any significant differences between men and women, or between university students and those studying for the professional diploma. The same was true of age in that no significant differences could be observed between the different age groups in any of the questions asked.

3.1. Perception of usefulness

The vast majority of the preservice teachers (84,9%) thought that the course on the application of ICT in education would be useful in their general professional training as future teachers within a framework of inclusive education (Figure 1).

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

Figure 1

Perceptions regarding the usefulness of the course

The participants highlighted the usefulness of the video tutorials and of the ARS tools; the answers to the questionnaire indicated that 97,6% of the preservice teachers either agree or strongly agree with the statement that these tools had enabled more efficient learning and improved the learning objectives.

The participants highlighted the usefulness of the video tutorials about which one of the female students explained: "we viewed the theoretical aspects together with the practical, which meant that we could see an immediate result (…) The explanatory videos to help us understand" (Student.C-FG). On similar lines, one of the male students stated that "the practical applications are very interesting. I think we are going to be able to use them a lot" (Student.B-FG).

91% of participants considered that watching videos was useful for working with classes with a range of needs and abilities, so that each person could learn at his or her own pace. This was confirmed in the focus group where one of the students commented: "it's good for enabling each one to learn at their own speed" (Student.D-FG).
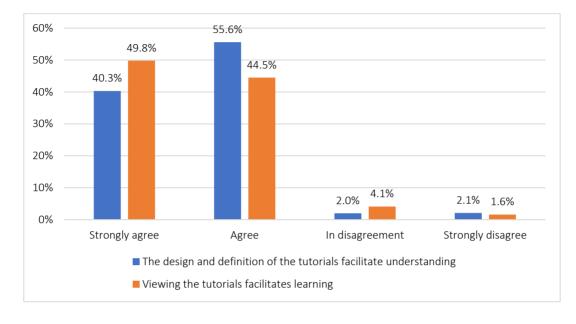
92% thought that the ARS offered useful feedback. One of the students in the focus group said that she thought ARS was very motivating and a very useful feedback tool: "I love it when you ask us to do Kahoots. I have fun and at the same time we revise all the most important concepts" (Student.E-FG).

3.2. Perception of ease of use

Most of the students felt that watching tutorials made learning easier. Equally, most of them considered that the video tutorials were well designed, clearly defined and easy to understand (Figure 2). In addition, the teachers who were giving the course on the inclusion

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

of ICT in the classroom believed that some of the digital resources were easier to use than others: "some of the digital resources are easier to use than others" (Counsellor-interview).

Figure 2

Perceptions regarding ease of use

Some of the students had hardly ever worked with ICT and as a result found the learning process more difficult. However, their attitudes changed over the course of the training period and were now more positive. One of the students described it like this: "you find it hard at the beginning but later you get up to speed" (Student.D-FG). One of the university students expressed a similar opinion in his response to the open question on the questionnaire "a fast but manageable rhythm"
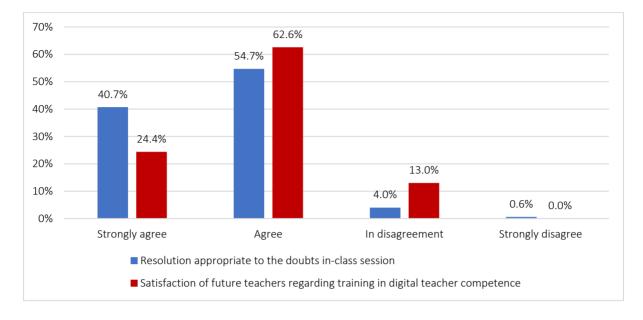
In spite of the fact that some of the ICTs were more difficult to use than others, the participants considered all of them suitable for use in classes with mixed abilities. The counsellor we interviewed stated: "they were quite capable of doing the conceptual maps task even though it is more complex" (Counsellor-interview).

3.3. Attitude and expectations

Most of the preservice teachers, considered that their professional training needs with regard to teacher digital competence had been satisfied. We also observed that almost everyone stated that the doubts that had arisen in the training sessions had been properly handled and resolved (Figure 3).

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250

Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

Figure 3

Attitudes and expectations.

From the qualitative analysis it was clear that after receiving this training there had been a shift in their attitudes towards a more positive outlook: "this course has aroused my curiosity … I was completely unaware that applications of this kind existed" (Trainee teacher - interview).

We also encountered a positive attitude in relation to the possibility of working at different learning speeds: "I think learning with videos was more satisfactory. Each person can go at their own pace" (preservice teacher-questionnaire).
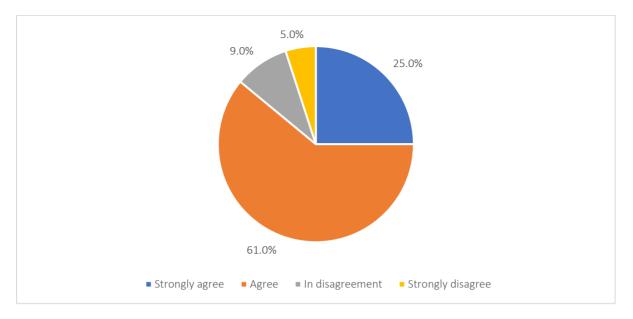
Most of the replies insisted on the need for further training and experience in ICT: "I felt that I should practice, even if I made mistakes or had to ask someone" (Student.B-FG).

3.4. Intention to use

Most preservice teachers said that they would use video-tutorials as a practical way for students to learn (Figure 4).

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

Figure 4

Intention to use

On similar lines, a preservice teacher argued in the questionnaire that "the teaching methodology must be changed". Numerous respondents stated their intention to use ICT: "I'm going to use ICT to learn and for teaching other people" (Trainee teacher -interview). Others were interested in learning more "Later we can carry on teaching other students (what we have learnt). You have motivated us to continue" (Student.A-FG).

3.5. Relations between variables

3.5.1. *Usefulness - Attitude*

As can be seen in Table 1, a significant correlation can be observed between the usefulness of the resources for enhancing teaching-learning processes (p=.000), for enabling each person to learn at their own pace (p=.002), and for achieving (p=.020) and consolidating (p=.000) the learning objectives with a positive attitude towards training in Teacher Digital Competence (TDC).

This corroborates some of the statements made by the participants in our study, who found the applications useful and therefore felt satisfied with them and felt they could be of benefit in their future students' learning process "I found it all very productive, for example the Storyjumper for story therapy" (Student.C-FG). They also made clear that these applications could help each person to learn at his or her own pace "a very good way to reach each person directly, to allow them to choose the pace that best suits them" (Student.D-FG).

3.5.2. *Usefulness - Intention to use*

We also observed a significant correlation between the usefulness of the videos for enhancing teaching-learning processes (p=.000), for promoting an individualized learning speed (p=.002) and for achieving (p=.000) the learning objectives regarding intention to use amongst future members of the teaching profession. There is also a significant correlation

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

(p=.011) between usefulness of the ARS and their intention to use it in their future teaching work. The student D explained it like this in focus group "some of the ICT applications can be used with disabled people, to explain things, to make a poster…".

3.5.3. Ease of use - Attitude

The variables related with the ease of use of the technological resources have a positive correlation with a positive attitude during the clarification of doubts (p=.040) and a high level of satisfaction about the training in TDC (p=.001). Likewise, their opinions regarding the clarity of the resources had a significant correlation with their satisfaction regarding the clarification of doubts (p=.002) and with their high degree of satisfaction about the training in TDC (p=.007). This coincided with the opinion of one of the students in the focus group "It was good because you find it hard at the beginning but later you get up to speed".

3.5.4. Ease of use - Intention to use

These same variables, ease of use and clarity of the technological resources, have a significant correlation with their intention to use in future teaching at a level of .000 and .004 respectively. In this regard, one of the students in the focus group said "I had no idea (...). I have considered the possibility of making a programme. It was difficult but I encouraged myself to keep going" (Student.B-FG). In the same way a preservice teacher verbalized their response to the open question as follows: "a fast but manageable pace. I have discovered many new programmes for my future".

Table 2

Correlations between variables

		USEFULNESS of resources for learning	EASE of use of resources	USEFULNESS tutorials for personalized learning speed	SATISFACTION during clarification of doubts	USEFULNESS of videos for achieving learning objectives	USEFULNESS of ARS for consolidating learning	EASE clarity of resources	INTENTION to use in future teaching	Positive ATTITUDE in TDC training
USEFULNESS of resources for learning	Pearson C.	1	.366**	.345**	.076	.237**	.267**	.326**	.196*	.328**
	Sig.(bil.)		.000	.001	.409	.009	.007	.000	.033	.000
EASE of use of resources	Pearson C.	.366**	1	.507**	.196*	.415**	.330**	.449**	.476**	.301**
	Sig.(bil.)	.000		.000	.040	.000	.001	.000	.000	.001
USEFULNESS tutorials for personalized learning speed	Pearson C.	.345**	.507**	1	.359**	.357**	.605**	.234*	.346**	.314**
	Sig.(bil.)	.001	.000		.000	.000	.000	.021	.001	.002
SATISFACTION during clarification of doubts	Pearson C.	.076	.196*	.359**	1	.312**	.355**	.278**	.462**	.377**
	Sig.(bil.)	.409	.040	.000		.001	.000	.002	.000	.000
USEFULNESS of videos for achieving learning objectives	Pearson C.	.237**	.415**	.357**	.312**	1	.482**	.295**	.369**	.214*
	Sig.(bil.)	.009	.000	.000	.001		.000	.001	.000	.020
USEFULNESS of ARS for consolidating learning	Pearson C.	.267**	.330**	.605**	.355**	.482**	1	.324**	.258*	.380**
	Sig.(bil.)	.007	.001	.000	.000	.000		.001	.011	.000

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250

Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

		USEFULNESS of resources for learning	EASE of use of resources	USEFULNESS tutorials for personalized learning speed	SATISFACTION during clarification of doubts	USEFULNESS of videos for achieving learning objectives	USEFULNESS of ARS for consolidating learning	EASE clarity of resources	INTENTION to use in future teaching	Positive ATTITUDE in TDC training
EASE clarity of resources	Pearson C.	.326**	.449**	.234*	.278**	.295**	.324**	1	.267**	.245**
	Sig.(bil.)	.000	.000	.021	.002	.001	.001		.004	.007
INTENTION to use in future teaching	Pearson C.	.196*	.476**	.346**	.462**	.369**	.258*	.267**	1	.663**
	Sig.(bil.)	.033	.000	.001	.000	.000	.011	.004		.000
Positive ATTITUDE in TDC training	Pearson C.	.328**	.301**	.314**	.377**	.214*	.380**	.245**	.663**	1
	Sig.(bil.)	.000	.001	.002	.000	.020	.000	.007	.000	

* Significant correlation level 0.05 (bilateral)
** Significant correlation level 0.01 (bilateral)

3.5.5. Attitude, Intention to use and Technological Pedagogical Content Knowledge

Quantitative analysis of the information revealed a network of relationships between acceptance of the technology and Technological Pedagogical Content Knowledge. The preservice teachers considered that the perception of ease of use and of intention to use are closely linked to technological knowledge "I was completely out of touch with the ICT world. It was quite difficult for me, quite complicated to understand the programmes and to think of ways to apply them" (Student.B-FG). Along similar lines, another participant described how her attitude had changed after the training course in TPCK: "My outlook has changed. I didn't think I liked this tool and now quite the opposite, I can see it's very interesting" (Student.G-FG).

The participants insisted on the need for training and practice in TPCK, so as to be able to use the technology bearing in mind the wide diversity of the students in the class: "it is all so interesting (…). In the end the training session wasn't long enough, but I'm going to continue by myself" (Student.H-FG); "When I did this more detailed work exercise, I discovered that it is possible to work with them and with all kinds of people" (Student.B-FG).

From a more specific viewpoint, the PK and PCK are aspects that emerge from the statements made by the participants when asked about their intention to use ICT: "For example, the StoryJumper, for making a story-book" (Student.B-FG). Along similar lines, another member of the focus group explained that ICT enables teachers to cover the diversity of abilities and needs of students "to be connected not only to obtain more information but also for creating things" (Student.A-FG). Video tutorials are perceived as an extremely valuable pedagogical tool: "If something is not quite clear, you can rewind or do it at the same time as in the video" (Trainee teacher -interview).

4. DISCUSSION

This study continues along similar lines to previous research (Blasco-Serrano et al., 2016, 2018) demonstrating the importance of the inclusion of ICT in learning and teaching, as a means of attending to the diverse needs of all the students (Sánchez et al., 2018; Sancho-Gil,

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250

Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

2019) and foster motivation and understanding, if it is accompanied by reflection (Blasco et al., 2018; Esteve-Mon et al., 2020).

The literature on this subject shows conflicting results as regards whether attitudes vary according to age. Scherer, Siddiq and Teo (2015) found that older teachers had more negative attitudes, a finding that contradicted the results of Muñoz and Cubo (2019), who discovered a positive relationship between age and attitude. Nor did we observe any gender-based differences, a result that contradicts those of Scherer et al. (2017), who found that male teachers felt more competent.

The results of previous research (Chilton & McCracken, 2017; Haghighi et al., 2019; Long et al., 2016) show that the participants view ICT as useful for learning. In particular, they considered videos to be a good means of enhancing learning (Domínguez & Palomares, 2020; Fidalgo-Blanco et al., 2017) because they offer students a clear and precise view of the entire procedure for the application of ITC to different educational processes related with different content areas. The flexibility offered by videos means that if necessary the students can also watch them in class while they are doing their exercises, so enabling each student to learn at his or her own pace and to work more independently at home without help from teachers (Perdomo, 2016). In line with the research by Slemmons et al. (2018), short videos facilitate learning for people with difficulties.

The participants also believe that ARS applications consolidate learning in that they provide immediate feedback and stimulate self-regulation of the learning process (Coma-Roselló et al., 2018). In addition, resolving the tasks set by these applications is a challenge that satisfies, motivates and activates the students (DeLozier & Rhodes, 2017), so improving their commitment and helping build their learning (Hunsu et al., 2016), as well as ensuring positive teacher-student interaction (Kim et al., 2009).

The participants in our study also highlighted that the various technological tools offered a wide range of possibilities for representation, production and motivation to attend to whole the diversity (Baldiris et al., 2016; Sánchez et al., 2018). For all these reasons, and in line with previous research, these applications are viewed as useful for learning and are well-received by teachers.

Clarity in the presentation and the structure of the videos and digital tools is also crucial in that it facilitates confidence in the applications and encourages the future teachers to use them in teaching and learning processes (Venkatesh & Bala, 2008). This highlights the importance of taking the Technology Acceptance Model (Pamuk et al., 2015; Venkatesh & Bala, 2008) into account in the initial training of teachers, given that the ICT applications and tools must be useful for learning and easy for teachers to use. They must also be motivating tools which both teachers and students enjoy using (Teo & Noyes, 2011).

in line with the TPCK model (Mishra & Koehler, 2006), the participants also insisted on the importance of having received pedagogical, technological and content training, because if not, as Sancho make clear, "digital competence was just an empty buzzword" (2017, 138). The participants were given training in the specific contents of the different applications (TCK) so as to enable them to apply them in their teaching practice in the relevant content areas (TPCK). Other researchers obtained similar results in that preservice teachers regarded

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

training and experience in digital competence as a necessity (Adell & Castañeda, 2010; Cabero-Almenara, & Palacios-Rodríguez, 2020; Kong & Lai, 2021; Molina et al., 2012). According to the findings of a study by Howard, Chan and Caputi (2014), training preservice teachers about the pedagogical possibilities and content of ICT was crucial for their use in future teaching practice. This is why ICT is such an important part of the syllabus for both primary and secondary teacher training (Engen, 2019; Sancho-Gil, 2019). This is especially important given that many current teachers have received little training in this field (Esteve-Mon et al., 2020; Pozo et al., 2020), as became clear during the Covid-19 pandemic when a lot of teaching was moved online.

This study had two complementary benefits. Firstly, the participants were trained in the use of ICT in their role as future teachers and secondly, they experienced ICT first hand, in ubiquitous, in-class environments in their role as students. This combination of experiences has caused many of them to reappraise their attitudes and has helped develop their teaching skills and in particular, their teacher digital competence (Coll & Engell, 2018). As agents of change, training in ICT has instilled new attitudes towards education practice in the preservice teachers and has updated their pedagogical beliefs and values (Ertmer & Ottenbreit-Leftwich, 2010; Vigo et al., 2019).

5. CONCLUSIONS

Our findings enable us to conclude that the attitudes of preservice teachers towards the use of videos and ARS improved during the training they received about the inclusion of technological applications in educational practice. They also confirmed their intention to use them in their future careers as teachers. They enjoyed the training course and their experience as users of a range of applications centred on pedagogical ideas for improving learning in various specific content areas.

The training course has helped the participants develop their digital skills and encouraged them to reflect on the usefulness of these applications as pedagogical tools. This experience has also brought about a change in their attitudes and beliefs about the incorporation of ICT into education practice. To this end, various participants emphasized the possibilities of technology when responding to the wide variety of needs within their classes. Educational flexibility, in terms of time, space and styles of learning, has become even more important during the Covid-19 pandemic, in which ICT has become an almost indispensable tool serving the entire educational population. In this sense, and in line with the TPCK framework, pre-service teachers should receive training in technology together with the necessary content and pedagogical skills to improve the use of technology in their classrooms (Wang et al., 2018)

This demonstrates the importance of developing teachers' digital skills in preservice and in-work teacher training. It is important to remember also that this digital training must be part of a transformative outlook on education through narratives centred on respect for diversity, critical thought and social justice (Nos et al., 2019; Sancho-Gil et al., 2019).

As a future line of research, it would be interesting to analyse how, after the right preservice training, teachers' digital skills could be developed during their professional careers. It would

also be interesting to assess the impact of ICT on their pedagogical values and beliefs, so as to facilitate its incorporation into schools that seek to attend to the full diversity of their students.

6. REFERENCES

Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. *Higher education research & development, 34*(1), 1-14, https://doi.org/10.1080/07294360.2014.934336

Adell, J., & Castañeda, L. (2010). Los Entornos Personales de Aprendizaje (PLEs): una nueva manera de entender el aprendizaje. En R. Roig Vila y M. Fiorucci (Eds.). *Claves para la investigación en innovación y calidad educativa. La integración de las tecnologías de la información y la comunicación y la interculturalidad en las aulas*. Marfil.

Azorín, C.M., Ainscow, M., Arnaiz, P., & Goldrick, S. (2019). A tool for teacher reflection on the response to diversity in schools. *Profesorado.Revista de Currículum y Formación de Profesorado, 23(1)*, 11-36. https://doi.org/10.30827/profesorado.v23i1.9142

Baldiris, S., Zervas, P., Fabregat, R., & Sampson, D.G. (2016). Developing Teachers' Competences for Designing Inclusive Learning Experiences. *Educational Technology & Society, 19*(1), 17–27.

Bergmann, J., & Sams, A. (2012). *Flip your classroom. Reach every students in every class every day.* Eugéne (Oregon,USA): International Society for Technology in Education.

Blasco-Serrano, A. C. & Dieste, B. (2021). Desarrollo de prácticas de enseñanza creativa e inclusiva con medios digitales. En C. Latorre & A. Quintas (Coords.), *Inclusión educativa y tecnologías para el aprendizaje,* (105-116). Octaedro.

Blasco, A.C., Lorenzo, J., & Sarsa, J. (2016). The flipped classroom and the use of educational software videos in initial teaching education. Qualitative study. *REALIA (TIC), 17*, 12-20. http://doi.org/10.7203/attic.17.9027

Blasco, A.C., Lorenzo, J., & Sarsa, J. (2018). Students' perception of flipped classroom through the use of social networks and classroom response systems. *Revista de Educación a Distancia, 57(6).* http://dx.doi.org/10.6018/red/57/6

Braun, V., & Clarke, V. (2014). What can "thematic analysis" offer health and wellbeing researchers? *International journal of qualitative studies on health and well-being*, *9 (1).* http://dx.doi.org/10.3402/qhw.v9.26152

Cabero-Almenara, J., & Palacios-Rodríguez, A. (2020). Marco Europeo de Competencia Digital Docente «DigCompEdu». Traducción y adaptación del cuestionario «DigCompEdu Check-In». *EDMETIC, 9* (1), 213-234. https://doi.org/10.21071/edmetic.v9i1.12462

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

Cabero-Almenara, J., & Valencia-Ortiz, R. (2019). TIC para la inclusión: una mirada desde Latinoamérica. Aula Abierta, 48(2), 139-146. https://doi.org/10.17811/rifie.48.2.2019.139-146

Chen, C.H., & Yeh, H.C., (2019). Effects of integrating a questioning strategy with game-based learning on students' language learning performances in flipped. *Technology, Pedagogy and Education,*28, *347-361.* https://doi.org/10.1080/1475939X.2019.1618901

Chilton, H. & McCracken, W. (2017). New technology, changing pedagogies? Exploring the concept of remote teaching placement supervision. *Higher Education Pedagogies, 2* (1), 116-130. https://doi.org/10.1080/23752696.2017.1366276

Colás, P.; Giuseppe, P., Pablos, J., Conde, J. & Villaciervos, P. (2019). Aplicaciones digitales para la inclusión. El proyecto europeo DEPIT. *Revista de Comunicación de la SEECI, 50*, 169-192. https://doi.org/10.15198/seeci.2019.50.169-192

Coll, C., & Engell, A. (2018). The Distributed Educational Influence Model A Conceptual and Methodological Tool for the Analysis of Collaborative Learning Processes in Digital Environments. *RED, 58*(1). http://dx.doi.org/10.6018/red/58/1

Coma-Roselló, T., Aguelo-Arguis, A., Álvarez, P., Sanz, C., & Baldassarri, S. (2018). Analysis of Innovative Approaches in the Class Using Conceptual Maps and Considering the Learning Styles of Students. *Revista Iberoamericana de Tecnologías del Aprendizaje, 13*(4), 120-129. http://dx.doi.org/10.1109/RITA.2018.2879388

DeLozier, S., & Rhodes, M. (2017). Flipped Classrooms: a Review of Key Ideas and Recommendations for Practice. *Educational Psychology Review, 29*(1), 141-151. https://doi.org/10.1007/s10648-015-9356-9

Domínguez, F. J., & Palomares, A. (2020). El "aula invertida" como metodología activa para fomentar la centralidad en el estudiante como protagonista de su aprendizaje. *Contextos educativos: Revista de educación, 26*, 261-275. https://doi.org/10.18172/con.4727

Engel, A. & Coll, C. (2021). Entornos híbridos de enseñanza y aprendizaje para promover la personalización del aprendizaje. *RIED. Revista Iberoamericana de Educación a Distancia, 25* (1), 225-242. https://www.redalyc.org/journal/3314/331469022014/movil/

Engen, B. K. (2019). Comprendiendo los aspectos culturales y sociales de las competencias digitales docentes. *Comunicar: Revista científica iberoamericana de comunicación y educación, 61,* 9-19. https://orcid.org/0000-0003-2446-8866

Ertmer, P.A. & Ottenbreit-Leftwich, A.T. (2010). Teacher Technology Change. *Journal of Research on Technology in Education, 42*(3), 255-284. https://doi.org/10.1080/15391523.2010.10782551

EDUTEC. Revista Electrónica de Tecnología Educativa. e-ISSN 1135-9250
Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T.

Issue 79: march 2022
Special Issue: Flexible education
in the age of open knowledge

Esteve-Mon, F., Castañeda, L., Adell-Segura, J. (2020). Un Modelo Holístico de Competencia Docente para el Mundo Digital. *Revista Interuniversitaria de Formación del Profesorado, 23*(2). http://aufop.com/aufop/revistas/indice/impresa/206

Fidalgo-Blanco, A., Martinez-Nuñez, M., Borrás-Gene, O., & Sanchez-Medina, J.J. (2017). Micro flip teaching–An innovative model to promote the active involvement of students. *Computers in Human Behavior*, *72*, 713-723. https://doi.org/10.1016/j.chb.2016.07.060.

Fuentes, A., López, J., & Pozo, S. (2019). Analysis of the Digital Teaching Competence: Key Factor in the Performance of Active Pedagogies with Augmented Reality. *REICE*, 17(2), 27-42. https://doi.org/10.15366/reice2019.17.2.002.

Haghighi, H., Jafarigohar, M., Khoshsima, H., & Vahdany, F. (2019). Impact of flipped classroom on EFL learners' appropriate use of refusal: achievement, participation, perception. *Computer Assisted Language Learning*, *32*(3), 261-293. https://doi.org/10.1080/09588221.2018.1504083

Howard, S.K., Chan, A., & Caputi, P. (2015). More than beliefs: Subject areas and teachers' integration of laptops in secondary teaching. *British Journal of Educational Technology*, *46*(2), 360-369. https://doi.org/10.1111/bjet.12139

Hunsu, N.J., Adesope, O., & Bayly, D.J. (2016). A meta-analysis of the effects of audience response systems (clicker-based technologies) on cognition and affect. *Computers & Education*, *94*, 102-119. https://doi.org/10.1016/j.compedu.2015.11.013

González, M. J.; Prieto, H. & Baptista, F. (2021). Didáctica del podcast en el programa PMAR. Una experiencia de aula en la Comunidad de Madrid. *RIED. Revista Iberoamericana De Educación a Distancia,* 25(1), 183–201. https://doi.org/10.5944/ried.25.1.30618

Janssen, N., Knoef, M., & Lazonder, A.W. (2019). Technological and pedagogical support for pre-service teachers' lesson planning, *Technology, Pedagogy and Education, 28*(1), 115-128, doi:10.1080/1475939X.2019.1569554

Kim, B., Park, H., & Baek, Y. (2009). Not just fun, but serious strategies: Using meta-cognitive strategies in game-based learning. *Computers & Education, 52*(4), 800-810, https://doi.org/10.1016/j.compedu.2008.12.004

Kong, S. C. & Lai, M. (2021). A proposed computational thinking teacher development framework for K-12 guided by the TPACK model. *Journal of Computers in Education,* 1-24. https://doi.org/10.1007/s40692-021-00207-7

Long, T., Logan, J., Cummins, J., & Waugh, M. (2016). Students' and instructor's attitudes and receptions of the viability of using a flipped classroom instructional model in a Technology-Enabled Active Learning (TEAL) classroom. *Journal of teaching and learning with technology*, *5*(1), 46-58. https://doi.org/10.14434/jotlt.v5n1.18879

Mishra, P., & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers college record*, *108*(6), 1017-1054.

Mauri, E., Carrera, X., Selga, M., Lopez, C., & Macià, M. (2016). Análisis de experiencias educativas con dispositivos móviles para una educación inclusiva. *Edutec. Revista Electrónica De Tecnología Educativa*, (56), a336. https://doi.org/10.21556/edutec.2016.56.658

Molina, M. D., Pérez, Álvaro, & Antiñolo, J. L. (2012). Las TIC en la formación inicial y en la formación permanente del profesorado de infantil y primaria. *Edutec. Revista Electrónica De Tecnología Educativa,* (41), a211. https://doi.org/10.21556/edutec.2012.41.353

Muñoz, E., & Cubo, S. (2019). Digital Competence, Special Education Teachers 'training and attitude towards the ICT. *Profesorado*, *23*(1), 209-241. https://doi.org/10.30827/profesorado.v23i1.9151

Nos, E., Farné, A., & Al-Najjar, T. (2019). Social Justice, Cultures of Peace and Digital Competences: Communication for Critical Global Citizenship in Higher Education. *RIEJS*. *8*(1), 43-62. https://doi.org/10.15366/riejs2019.8.1.003

Pamuk, S., Ergun, M., Cakir, R., Yilmaz, H.B., & Ayas, C. (2015). Exploring relationships among TPACK components and development of the TPACK instrument. *Education and Information Technologies*, *20*(2), 241-263, https://doi.org/10.1007/s10639-013-9278-4

Perdomo, W. (2016). Estudio de evidencias de aprendizaje significativo en un aula bajo el modelo Flipped Classroom. *Edutec. Revista Electrónica De Tecnología Educativa,* (55). https://doi.org/10.21556/edutec.2016.55.618

Rose, D. H. & Meyer, A. (2002). *Teaching Every Student in the Digital Age: Universal Design for Learning.* Association for Supervision and Curriculum Development.

Sánchez, J. M., Alba, C., & Sánchez-Antolín, P. (2018). Valoraciones del alumnado de Educación Primaria sobre lecturas digitales diseñadas con UDL Book-Builder como apoyo en los procesos lectores. *Aula abierta*, 47(4), 481-490. https://doi.org/10.17811/rifie.47.4.2018.481-490

Sancho, J.M. (2017). Discourses and Practices around the Competencies in Education. *Fonseca. Journal of Communication, 15, 127-144*. https://doi.org/10.14201/fjc201715127144

Sancho-Gil, J.M. (2019). De la tecnología para aplicar a la tecnología para pensar: implicaciones para la docencia y la investigación. *Revista Latinoamericana De Tecnología Educativa. RELATEC*, 18(1), 9-22. https://doi.org/10.17398/1695-288X.18.1.9

Scherer, R., Tondeur, J., & Siddiq, F. (2017). On the quest for validity: Testing the factor structure and measurement invariance of the technology-dimensions in the Technological, Pedagogical, and Content Knowledge (TPACK) model. *Computers & Education*, *112*, 1-17. https://doi.org/10.1016/j.compedu.2017.04.012

Scherer, R., Siddiq, F., & Teo, T. (2015). Becoming more specific: Measuring and modeling teachers' perceived usefulness of ICT in the context of teaching and learning. *Computers & Education*, *88*, 202-214. https://doi.org/10.1016/j.compedu.2015.05.005

Slemmons, K., Anyanwu, K., Hames, J., Grabski, D., Mlsna, J., Simkins, E., & Cook, P. (2018). The Impact of Video Length on Learning in a Middle-Level Flipped Science Setting: Implications for Diversity Inclusion. *Journal of Science Education and Technology, 27*, 469-479. https://doi.org/10.1007/s10956-018-9736-2

Sohrabi, B. & Iraj, H. (2016). Implementing flipped classroom using digital media: A comparison of two demographically different groups perceptions. *Computers in Human Behavior, 60*, 514-524., http://dx.doi.org/10.1016/j.chb.2016.02.056

Suárez-Guerrero, C., Rivera-Vargas, P., & Rebour, M. (2020). Preguntas educativas para la tecnología digital como respuesta. *Edutec. Revista Electrónica De Tecnología Educativa*, (73), 7-22. https://doi.org/10.21556/edutec.2020.73.1733

Tashakkori, A. & Teddlie, C. (2003). Cuestiones y dilemas en la enseñanza de cursos de métodos de investigación en ciencias sociales y del comportamiento: perspectiva estadounidense. *Revista internacional de metodología de la investigación social,* 6 (1), 61-77.

Teo, T., & Noyes, J. (2011). An assessment of the influence of perceived enjoyment and attitude on the intention to use technology among pre-service teachers: A structural equation modeling approach. *Computers & education*, *57*(2), 1645-1653. https://doi.org/10.1016/j.compedu.2011.03.002

Torrecilla, S., & García, M. (2020). Flipped Classroom: estrategias de aprendizaje y rendimiento en ciencias. *EDUTEC. Revista Electrónica De Tecnología Educativa*, (72), 112-124. https://doi.org/10.21556/edutec.2020.72.1525

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision sciences, 39*(2), 273-315.

Vigo, M.B. (2021). Desarrollo de prácticas de enseñanza creativa e inclusiva con medios digitales. En C. Latorre y A. Quintas (Coords.), *Inclusión educativa y tecnologías para el aprendizaje* (129-144). Octaedro.

Vigo-Arrazola, M.B. y Dieste-Gracia, B. (2019). Building virtual interaction spaces between family and school. *Ethnography and Education*, 14(2), 206-222. https://doi.org/10.1080/17457823.2018.1431950

Wang, W., Schmidt-Crawford, D., & Jin, Y. (2018) Preservice Teachers' TPACK Development: A Review of Literature, *Journal of Digital Learning in Teacher Education*, 34(4), 234-258. https://doi.org/10.1080/21532974.2018.1498039

7. Funding

To cite this article

Blasco-Serrano, A. C., Bitrián González, I., & Coma-Roselló, T. (2022). La integración de la tecnología digital en la formación inicial docente, desde una perspectiva inclusiva . *Edutec. Revista Electrónica De Tecnología Educativa*, (79), 9-29. https://doi.org/10.21556/edutec.2022.79.2393