Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto

Techno-pedagogical resources to support teaching: Augmented reality as a dynamic tool for the substitute teacher

Jesús López Belmonte.
International University of Valencia.
AREA Research Group (HUM-672).
jesus.lopezb@campusviu.es

Santiago Pozo Sánchez.
University of Granada.
AREA Research Group (HUM-672).
santiagopozo@correo.ugr.es

Arturo Fuentes Cabrera.
University of Granada.
AREA Research Group (HUM-672).
arturofuentes@ugr.es

RESUMEN.
La educación actual está marcada por un proceso de actualización tecnológica, siendo la realidad aumentada (RA) una de las tecnologías con mayor proyección en el ámbito educativo. Se trata de una innovadora técnica que genera una realidad intermedia entre el entorno físico y el mundo virtual, a través de la conversión de objetos cotidianos a elementos digitales en 3D, permitiendo a sus usuarios interactuar con ellos a través de un dispositivo móvil. Esta tecnología permite adaptarse a cualquier situación, como aquellos momentos en los que un docente tiene que sustituir a otro durante la jornada escolar. El objetivo del presente estudio se centra en conocer la influencia que ejerce en el alumnado de Educación Secundaria Obligatoria la aplicación de una experiencia innovadora basada en la utilización de la RA como herramienta dinamizadora de las sesiones en las que el profesor titular de una asignatura se encuentra ausente y tiene que ser suplido por otro docente. Para ello se ha seguido un diseño no experimental de tipo descriptivo y correlacional, a través de un método cuantitativo. Se ha aplicado un cuestionario *ad hoc* en una muestra de 210 alumnos, de un centro educativo de Ceuta (España). Los resultados reflejan que la puesta en práctica de la experiencia ha contribuido al alcance de valores positivos en la motivación y participación discente, consecución de objetivos, competencia digital, clima de aula y todo ello con escasas dificultades en los discentes, hallándose diferencias estadísticamente significativas en cuanto al género y curso del alumnado.

PALABRAS CLAVE.
Realidad aumentada, experiencia innovadora, sustitución del profesorado, ambientes enriquecidos.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), 12, 122-136
ISSN: 2386-4303

ABSTRACT.
Current education is marked by a process of technological updating, with augmented reality (AR) being one of the technologies with the greatest projection in the educational field. It is an innovative technique that generates an intermediate reality between the physical environment and the virtual world, through the conversion of everyday objects to digital elements in 3D, allowing its users to interact with them through a mobile device. This technology allows adapting to any situation, such as those moments in which a teacher has to replace another during the school day. The objective of this study is to know the influence exercised in the students of secondary education the application of an innovative experience based on the use of the AR as a dynamic tool of the sessions in which the professor of a subject is absent and has to be replaced by another teacher. To this end, a non-experimental design of a descriptive and correlational type was followed through a quantitative method. An *ad hoc* questionnaire was applied to a sample of 210 students from an educational center in Ceuta (Spain). The results reflect that the implementation of the experience has contributed to the reach of positive values in motivation and student participation, achievement of objectives, digital competence, classroom climate and all this with few difficulties in the students, being statistically significant differences in regarding the gender and course of the student body.

KEY WORDS.
Augmented reality, innovative experience, teacher substitution, enriched environments.

1. Introduction.

A few years ago, technology was presented as an incredibly new world, closer to the future than to the present. Nowadays, however, information and communication technologies (ICT) are a reality in the daily life of the individuals that make up today's society. Its impressive rise is closely related to the great digital advances experienced in the field of technological research. Therefore, we are facing a social paradigm shift whereby the majority of the population goes to technological tools to carry out their daily tasks (Jódar, 2010).

Area (2015) points out that, under this technological panorama, society has been forced to learn new concepts and to handle new devices that until then were unknown, being the youth population that has managed to acclimatize to the digital world with greater ease.

In a similar line, Sánchez and Castro (2013) add that, within this paradigm shift, we find two social protagonists. On the one hand, the digital immigrant, that individual who has needed an important effort to be able to operate in the technological world, because due to their relatively advanced age, they understand that technological devices are alien to their reality. On the other hand, the digital native, the one born in a technological society and flooded with digital devices and who, because of his young age, has learned to use them in an innate way.

If we transfer this social reality to the educational panorama, it is essential that educational spaces are incorporated into technological innovation and use ICT as an indispensable pedagogical tool (Ortega, 2009), for which a correct supply of digital equipment and technological devices is indispensable part of the educational institutions (Méndez and Delgado, 2016).

Conducting an analysis of current legislation in education, special emphasis is observed in the use of ICT in the classroom as flattering tool student learning. Royal Decree 1105/2014 of 26 December, the core curriculum of Compulsory Secondary Education and Baccalaureate is set, determines that digital competence is crucial for the overall development of the student element being essential to incorporate ICT educational spaces, image and likeness of reality who experience these students in their daily lives. These regulations also state that one of the objectives of the stage of secondary education is that learners get "acquire a basic competence in the field of technology, 8/2013 Organic Law of 9 December, to improve educational quality (LOMCE) provides that ICT will be used in all subjects included in the curriculum and teachers serve as relevant and essential teaching tool in the work teacher.

This situation reveals that education is undergoing a process of educational reform with the incorporation of technological elements that transport learners to experience great learning experiences (Cabero and Barroso, 2018), simply and with a large recreational load, with the augmented reality (AR) and ideal for optimal introduced and used in the educational (Cabero, Vázquez and López, 2018) technology. It is considered as a bridge between the reality in which people live and purely virtual spaces (Cabero, Leiva, Moreno Barroso and López, 2016).

Authors such as Aznar, Romero and Rodriguez (2018), Cabero, García-Jiménez and Barroso (2016), Cabero and Marín (2018) Moreno, Leiva and López (2016) define the AR as a technology that manages to combine the real world and digital synchronous parallel and encouraging enrichment materials at its disposal the student, increasing levels of participation and interaction, while playful learning scenarios are created. For his part, Moreno Leiva and Matas (2016) state in their studies that AR stands as an emerging technology that is having a major impact on the educational landscape.

Previous studies have determined that the AR energizes the teaching and learning process (De la Horra, 2017), enhances the interest and motivation of the student (Cubillo, Martín Castro and Colmenar, 2014), promoting their active role, making it an essential tool for building your own learning (Fernandez, 2018). It also allows an adaptation to each learner profile in order to carry out meaningful learning based on individualized teaching (Maquilón, Mirete and Avilés, 2017).

Moreover, the use of educational technology level of AR, also requires optimal teacher training in technology, a student body with minimal skills in digital competence and adequate classroom materials requirements to carry out activities proposals (Álvarez, Delgado, Gimeno, Martín, Almaraz and Ruiz, 2017).

For the implementation of experiences with AR it is essential to use a mobile device. So this technology is seen as a specific part of the so called mobile learning (Fombona, Pascual and Gonzalez, 2017), creating interactive and cooperative scenarios with high recreational component (Ramírez and García, 2017) that promote improved classroom atmosphere (Montijano and De Esteban, 2017).

Likewise, the use of these ICT resources fosters the work and development of digital competence of learners, conforming as a primary requirement given the characteristics of today's society (Huertas and Pantoja, 2016) and facilitate the achievement of curricular objectives set by the teacher (Bautista, Martinez and Hiracheta, 2014).

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), 12, 122-136
ISSN: 2386-4303

Brazuelo and Gallego (2014) define mobile learning as a kind of ubiquitous teaching that allows knowledge of students be built anywhere and anytime, through technological devices and combining both the autonomy of the student and cooperative work.
experts as De la Torre, Martín, Saorín, Carbonell and Contero (2013) have found that AR as graphics technology, to convert realities of two-dimensional digital 3D objects, causing a motivating reaction in the student that favors their interaction with the device and the task you are performing.
Based on the above, it has been determined that the overall objective of this study is to know the influence in students of Secondary Education the use of augmented reality as a dynamic tool sessions in which the head teacher of a subject is absent and needs to be optionally supplied.
Parallel and complementary, are formulated based on the following objectives greater specificity:

- Find the learner profile of the cooperative studied teaching.
- To know the motivation level, digital competence, participation and difficulty in performing innovative work.
- Determine achieving goals by the learners in teaching and innovative learning.
- Discover the incidence of innovative experience in climate originated in the learning space.
- Finding out the influence of gender and course of the learners regarding motivation, participation, student difficulty achieving the objectives, the school climate and generated digital competence achieved.

2. Material and methods.

At certain times, a teacher has to deal with situations that do not dominate because their training and skills acquired during their training period and work experience have focused on a field of knowledge in particular, resulting in episodes of insecurity, stress and fear seize him, to be out of your comfort zone (Fores, Sánchez and Sancho, 2014). It is intended to refer to those scenarios in which this professional education must provide content that is not their specialty, correct tasks and even answer questions formulated by students on a particular aspect of a subject in which the teacher is not expert but simply makes a labor substitution.
Given this problem, the study of the need to find a tool that allows teachers teach in any area of the curriculum in situations where the professor is absent for various reasons such as illness or any other matter do not let him go to school.
This research was carried out in a school in Ceuta (Spain), especially in a cooperative education, a type of school characterized by innovation, quality, organizational leadership and teacher training following their career in order to achieve educational excellence, as highlighted by López (2017), López and Fuentes (2018) López, Fuentes and Moreno (2018) and Lopez, Moreno and Pozo (2018), in their studies.
The cooperative teaching in question is Beatriz Concerted Centro de Silva, educational institution that is located in the center of the city providing a service ranging from pre-school

to Secondary Education (SE), with a multicultural population covered by 710 students, characterized by socioeconomic medium character.

In particular, this study was carried out at the stage of SE, covering all students (n = 210) corresponding to different courses configured such educational stage. These subjects were selected for directed sampling or convenience (Hernández, Fernández and Baptista, 2014), due to the ease of access to these participants.

The main characteristics of the participants are contained in Table 1 referring to the variables gender, age, course, religion and nationality, by using statistics such as the number of students (n) Total population (N), average (Av), standard deviation (SD) and percentage (%).

Gender					Age		
Course	Boy		Girl				
	n	%	n	%	N	Av	DT
1st SE	31	14.76	29	13.81	60	13	1.4
2nd SE	29	13.81	31	14.76	60	14	0.9
3rd SE	26	12.38	24	11.43	50	15	1.1
4th SE	18	8.57	22	10.48	40	16	1.3
Total	104	49.52	106	50.48	210	14,5	1.175

Religion							Nationality					
Course	Christian		Muslim		Other		Spanish		Moroccan		Other	
	n	%	n	%	n	%	n	%	n	%	n	%
1st SE	20	9.52	25	11.91	15	7.14	55	26.19	3	1.43	2	.95
2nd SE	23	10.95	24	11.43	13	6.19	56	26.67	2	.95	2	.95
3rd SE	22	10.47	21	10	7	3.33	47	22.38	2	.95	1	.48
4th SE	17	8.1	19	9.05	4	1.91	37	17.62	2	.95	1	.48
Total	82	39.04	89	42.39	39	18.57	195	92.86	9	4.28	6	2.86

Table 1. Features of the sample.
Source: self-made.

To develop this study has followed a non-experimental design descriptive and correlational nature, through a quantitative methodology (McMillan and Schumacher, 2005). As an instrument for data collection, an *ad hoc* questionnaire was used with the intention of optimizing the results and being able to offer specific answers to the needs and requirements of the research.

As data collection instrument has been used an ad hoc questionnaire intended to optimize results and to provide concrete answers to the needs and requirements of research (Alaminos and Castejón, 2006).

Such an instrument is formed by a total of 34 items, with a response format possibilities Likert 4, 1 being the 4 most positive and most negative value. Issues that arise are structured in 4 dimensions that have been analyzed through the reliability index by statistical Alpha Cronbach (α), whose results are presented below:

a) Sociodemográfica: 6 items; α = 0.847.
b) Innovative experience: 12 items; α = 0.861.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), 12, 122-136
ISSN: 2386-4303

c) Student attitude: 8 items; α = 0.833.
d) Digital competence: 8 items; α = 0.829.

Obtaining a mean value of α = 0.843 reliability in the entirety of the instrument, following Bisquerra (2004) lists the result as a highly reliable and internal consistency among the items established to be a value between the range instrument. 8-1.
In addition, the questionnaire was evaluated by an expert opinion (Escobar y Cuervo, 2008) composed of 8 Doctors specialists in the field of study that were responsible for validating the instrument in order to optimize their effectiveness in the collection process data.
Prior to the actual application of the instrument step, a pilot (Corral, 2009) was performed on another cooperative education in the same city with the aim of reducing all problems related to the field work and avoid any bias that may affect to the investigation.
Once optimized the instrument began the research process, particularly in the first quarter of 2018 in which different actions were developed. First, a meeting with the management team of the center in question remained to produce an approach and present the research objectives with the intention of obtaining the necessary authorization to carry out the study. Then, after a favorable consent, the preparation phase of worksheets (Figure 1) for students started. These were equipped with a QR code that, after reading a device Mobile, launched a website with audiovisual resources training nature, previously developed by the various members of the faculty.

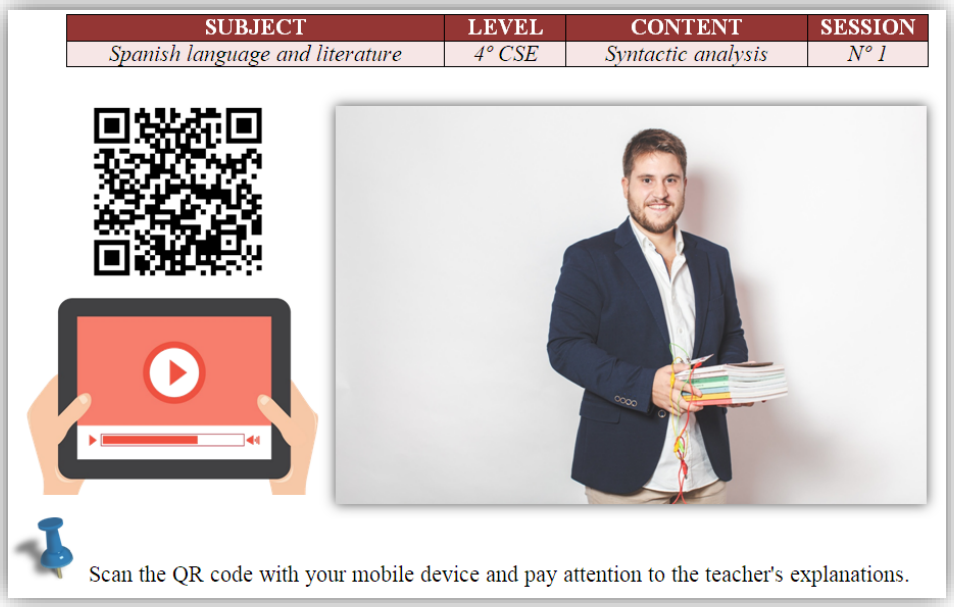

Figure 1. Model worksheet AR enriched with technology.
Source: self-made.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), *12*, 122-136
ISSN: 2386-4303

This cooperative education, despite considering an innovative center, had no digital resources needed to develop this experience, so we had to make a type authorization contract so that students could bring their phones to the center device, assuming a series of conditions and requirements for proper use of technology. This requires a BYOD or bring your own device model, based on the learner's own technology, one that uses at home for social purposes now also used in the school to supplement their training (Sánchez and Toledo, 2017) was used.

Subsequently, it was found that the bandwidth of the optical fiber which had the school could take, no problem, the internet connection thirty tablets housed viewing multimedia content on the network. All tests were satisfactory so the investigation was not affected at any time.

Once all the checks carried out the implementation of innovative experience in each of the courses research participants (Figure 2) and its subsequent process of data collection through the questionnaire, which was respected in all times the anonymity of subjects (Garcia Alfaro Hernandez and Molina, 2006).

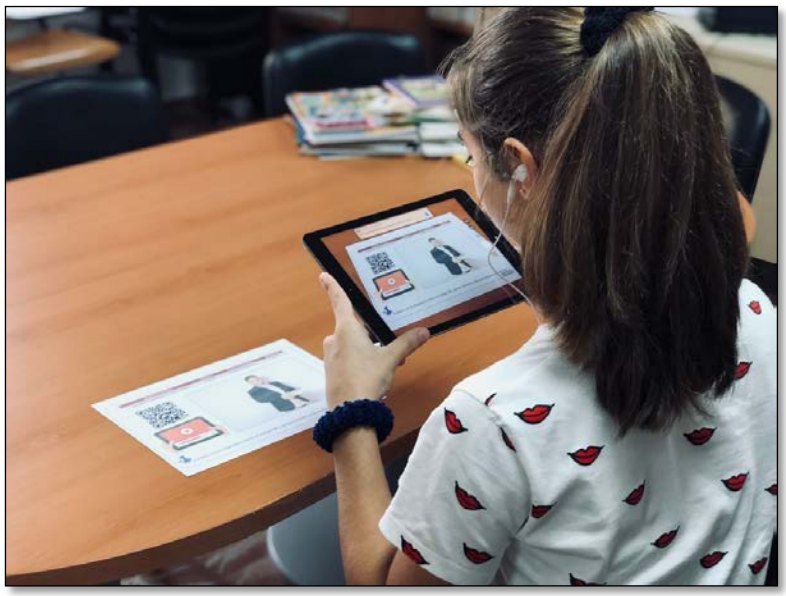

Figure 2. Student enriched by accessing AR material.
Source: self-made.

For this study we have used the following variables:

- GEN: Gender participants.
- CURS: Course in which he is enrolled students.
- RE: Religion of students.
- NAT: Nationality of the learners.
- MOTIV: Motivation generated in the proposed tasks.
- DEGR: Degree of achieving the stated objectives for the session.
- PARTI: Student participation in activities.
- DIFCL: Difficulties generated during the process of teaching and learning.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), *12*, 122-136
ISSN: 2386-4303

- CLIM: Climate originated in the learning space.
- CD: Student demonstrated competence in digital tasks.

The software used to analyze statistically the data obtained was the Statistical Package for Social Sciences (SPSS) v.20, considering p <0.05 as statistically significant difference, with confidence level (Z) of 95% and a margin of error (e) 5%.
For the presentation data have been used as statistical average (M), The standard deviation (SD), the skewness coefficient (CAP) and the coefficient of pointing Fisher (CAF). For comparison of variables has been carried out the Chi-square (χ2) test and V of Cramer (V) (Landero y González, 2006).

3. Results.
Then the results obtained after the process of analysis and quantification of the data collected are presented. Table 2 shows the valuations expressed by the learners in each of the study variables, highlighting positive learning climate generated by the AR technology, followed by the active participation of students are presented, the degree of achievement of the objectives, motivation generated by this experience and work of digital competence.

	Likert scale *n (%)*				**parameters**			
	Nothing	**Little bit**	**Quite**	**Totally**	**M**	**SD**	**CAP**	**CAF**
MOTIV	21 (10)	30 (14.28)	117 (55.72)	42 (20)	2.8571	8499	2.1849	0811
DEGR	33 (15.71)	22 (10.48)	78 (37.14)	77 (36.67)	2.9476	1.0474	1.8593	-.6782
PARTI	11 (5.24)	16 (7.62)	62 (29.52)	121 (57.62)	3.3952	8401	2.8512	1.2111
DIFCL	57 (27.14)	76 (36.19)	50 (23.81)	27 (12.86)	2.2238	9867	1.2402	-.916
CLIM	15 (7.14)	13 (6.19)	42 (20)	140 (66.67)	3.4619	8949	2.7508	1.6325
CD	38 (18.09)	35 (16.67)	62 (29.52)	75 (35.72)	2.8285	1.1037	1.6567	-1.1305

Table 2. Results obtained for the study variables.
Source: self-made.

As for the correlation between gender of learners and the different variables taken (MOTIV DEGR, PARTI, DIFCL, CLIM and CD) is determined according to the values obtained in the tests [*χ2 (df), p*-value, V], With Z = 1.96; e = .05, which is only found statistically significant differences in climate generated in the learning space (p <.05), this variable declining itself favorably to the female gender, but establishing a low level of dependence between GEN-CLIM (V = .215), As shown in Table 3.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), 12, 122-136
ISSN: 2386-4303

	Gender *n (%)*		Parameters		
Likert	**Boy**	**Girl**	***χ2 (df)***	***p*-value**	**V**
MOTIV			76 (3)	.86	.061
Nothing	11 (5.24)	10 (4.76)			
Little bit	14 (6.67)	16 (7.62)			
Quite	56 (26.67)	61 (29.05)			
Totally	23 (10.95)	19 (9.05)			
DEGR			81 (3)	.847	.062
Nothing	15 (7.14)	18 (8.57)			
Little bit	10 (4.76)	12 (5.71)			
Quite	38 (18.1)	40 (5.19)			
Totally	41 (19.52)	36 (17.14)			
PARTI			5.21 (3)	.157	.158
Nothing	7 (3.33)	4 (1.91)			
Little bit	7 (3.33)	9 (4.28)			
Quite	24 (11.43)	38 (18.1)			
Totally	66 (31.43)	55 (26.19)			
DIFCL			59 (3)	.899	.053
Nothing	26 (12.38)	31 (14.76)			
Little bit	39 (18.57)	37 (17.62)			
Quite	26 (12.38)	24 (11.42)			
Totally	13 (6.19)	12 (5.71)			
CLIM			**9.68 (3)**	**.021**	**.215**
Nothing	11 (5.24)	4 (1.91)			
Little bit	5 (2.38)	8 (3.81)			
Quite	27 (12.86)	15 (7.14)			
Totally	61 (29.05)	79 (37.62)			
CD			41 (3)	.939	.044
Nothing	19 (9.05)	19 (9.05)			
Little bit	18 (8.57)	17 (8.1)			
Quite	32 (15.24)	30 (14.28)			
Totally	35 (16.67)	40 (5.19)			

Table 3. Association between gender and other variables of study.
Source: self-made.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), *12*, 122-136
ISSN: 2386-4303

Regarding the correlation between the course and the other variables contained in Table 4, it was found statistically significant differences in motivation (p-0.008), with an average degree of dependence between CURS-MOTIV (V = .564), and the climate originated (p-0.001) by the AR environment, reflecting a high level of dependence between variables CURS-CLIM (V = 0.781) at a confidence level of 95% and an error margin 5%. For MOTIV, it is the first course of SE which presented a higher level of motivation while performing experience. But in CLIM it is the second year of SE which has a better working environment.

	Course *n (%)*				**Parameters**			
Likert	**1st SE**	**2nd SE**	**3rd SE**	**4th SE**	***χ2 (df)***	***p*-value**	**Cont.**	**V**
MOTIV					**22.26 (9)**	**.008**	**.311**	**.564**
Nothing	5 (2.38)	6 (2.86)	6 (2.86)	4 (1.91)				
Little bit	7 (3.33)	10 (4.76)	7 (3.33)	6 (2.86)				
Quite	25 (11.9)	32 (15.24)	32 (15.24)	28 (13.33)				
Totally	23 (10.95)	12 (5.71)	5 (2.38)	2 (95)				
DEGR					6.79 (9)	.659	.177	.311
Nothing	10 (4.76)	9 (4.29)	8 (3.81)	6 (2.86)				
Little bit	6 (2.86)	5 (2.38)	7 (3.33)	4 (1.91)				
Quite	22 (10.48)	18 (8.57)	18 (8.57)	20 (9.52)				
Totally	22 (10.48)	28 (13.33)	17 (8.09)	10 (4.76)				
PARTI					2.14 (9)	.989	.101	.175
Nothing	4 (1.91)	2 (95)	3 (1.43)	2 (95)				
Little bit	6 (2.86)	4 (1.91)	3 (1.43)	3 (1.43)				
Quite	18 (8.57)	19 (9.05)	15 (7.14)	10 (4.76)				
Totally	32 (15.24)	35 (16.67)	29 (13.81)	25 (11.91)				
DIFCL					7.18 (9)	.618	.182	.32
Nothing	16 (7.62)	17 (8.09)	17 (8.09)	7 (3.33)				
Little bit	23 (10.95)	24 (11.43)	14 (6.67)	15 (7.14)				
Quite	12 (5.71)	15 (7.14)	11 (5.24)	12 (5.71)				
Totally	9 (4.29)	4 (1.91)	8 (3.81)	6 (2.86)				
CLIM					**42.63 (9)**	**.0001**	**.411**	**.781**
Nothing	8 (3.81)	3 (1.43)	2 (95)	2 (95)				
Little bit	5 (2.38)	3 (1.43)	2 (95)	3 (1.43)				
Quite	26(12.38)	9 (4.29)	5 (2.38)	2 (95)				
Totally	21 (10)	45 (21.43)	41 (19.52)	33 (15.71)				

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), 12, 122-136
ISSN: 2386-4303

CD			3.73 (9) .928	.132 .231
Nothing	10 (4.76)	13 (6.19)	8 (3.81)	7 (3.33)
Little bit	11 (5.24)	10 (4.76)	8 (3.81)	6 (2.86)
Quite	18 (8.57)	20 (9.52)	15 (7.14)	9 (4.29)
Totally	21 (10)	17 (8.09)	19 (9.05)	18 (8.57)

Table 4. Association between the course of students and other study variables.
Source: self-made.

4. Discussion and conclusions.

Starting from the main results achieved in this study is obtained, as in previous research by Cabero and Marín (2018), Cubillo, Martín Castro and Colmenar (2014) and Moreno, Leiva and López (2016), the AR use of technology as an innovative resource for teaching has led to a high rate of participation of learners, leading, in turn, the active role being pursued today in this figure, as the principal agent of the learning process.

Also, the motivation has increased as already established Cubillo, Martín Castro and Colmenar (2014), De la Torre, Martín, Saorín, Carbonell and Contero (2013), by creating a fun learning environment, different traditional, and where students can interact with content using mobile devices that generate the mixed reality enriched, causing charge special relevance flat objects through the screen.

As recently ahead Montijano and De Esteban (2017), the school's use of the AR improves classroom atmosphere, referring to aspects related to attitude, behavior, coexistence, work, dedication of the students against the activity and contents. Actions which are very positive to optimize the learning process, focusing the learner on task and causing a visual stimulus that incites him to work unconsciously formulated objectives for each session.

Such experiences need several requirements, one being the digital competence of student (Álvarez, Delgado, Gimeno, Martín, Almaraz and Ruiz, 2017), primarily to develop activities involving the use and handling of digital tools element effectiveness. However, the work done by students, as determined Sanchez and Castro (2013), has not had great difficulty in achieving the goals proposed practice with AR made, since the subjects participating in the study have a native nature in its technological aspect, being familiar from an early age to be in contact with all kinds of innovative resources. Therefore, coinciding with Huertas and Pantoja (2016), with regard to the achievement of curricular objectives set by the teacher in planning and programming activity, as postulated Bautista Martinez and Hiracheta (2014), the use of technology in the field of education has promoted that these items are achieved favorably and satisfactorily.

Entering a higher degree of research realization after study it has verified that the AR has allowed exercise enabling tool of teaching in those cases where teachers have to impart some content that is not a specialist or supplement another professional for a variety of issues, developing their role in an unsafe environment by fear and stress that can lead to performing tasks that are not specific to their area of expertise.

This research has shown that a teacher who replaces another, being from different academic specialties, thanks to the AR has achieved high levels of motivation and student participation, and the establishment of a positive climate in the classroom, the scope of the objectives, the work of digital competence, solving in this way the difficulties outlined by the teaching staff.

Based on statistical tests used, they were obtained statistically significant in both gender as during student differences. In the first climate-related differences classroom are being girls who have a more favorable opinion on this issue. Referring to the course where they are enrolled, they are again-from differences in the CLIM variable that predominates in the second year of SE, as well as motivation in which positive results are reflected in the first year.

We conclude that AR technology has managed to solve the problem that has led to this study, by allowing any teacher, regardless of specialty, to replace another professional education through the generation of a mixed reality about the students visualize other teaching in a digital environment, which has achieved fully satisfactory results.

The main limitation of this research has focused on the difficulties associated with technological resources, because the school did not have mobile devices to all students in a classroom, so they had to resort to a BYOD method to make such experience, being in the same space different types of devices with different specifications. Nevertheless, all they performed smoothly reading of the QR code and displaying the visual material.

As a future line of research is to know the teaching digital competence in concerted cooperative nature centers and verify whether this group has the skills to enrich teaching materials through the AR.

5. References.

- Alaminos, A., & Castejón, J. L. (2006). *Elaboración, análisis e interpretación de encuestas, cuestionarios y escalas de opinión.* Alicante: Marfil.
- Álvarez, S., Delgado, L., Gimeno, M. A., Martín, T., Almaraz, F., & Ruiz, C. (2017). El arenero educativo: la realidad aumentada un nuevo recurso para la enseñanza. *EDMETIC*, *6*(1), 105-123.
- Area, M. (2015). La alfabetización digital y la formación de la ciudadanía del siglo XXI. *Revista Integra Educativa, 7*(3), 21-33.
- Aznar, I., Romero, J. M., & Rodríguez, A. M. (2018). La tecnología móvil de Realidad Virtual en educación: una revisión del estado de la literatura científica en España. *EDMETIC, Revista de Educación Mediática y TIC, 7*(1), 256-274.
- Bautista, M. G., Martínez, A. R., & Hiracheta, R. (2014). El uso de material didáctico y las tecnologías de información y comunicación (TIC's) para mejorar el alcance académico. *Ciencia y tecnología*, *1*(14), 183-194.
- Bisquerra, R. (2004). *Metodología de la investigación educativa.* Madrid: La Muralla.
- Brazuelo, F., & Gallego, D. (2014). Estado del Mobile Learning en España. *Educar em Revista,* (4), 99-128.
- Cabero, J., & Barroso, J. (2018). Los escenarios tecnológicos en Realidad Aumentada (RA): posibilidades educativas en estudios universitarios. *Aula Abierta, 47*(3), 327-336.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), 12, 122-136
ISSN: 2386-4303

- Cabero, J., García-Jiménez, F., & Barroso, J. (2016). La producción de objetos de aprendizaje en "Realidad Aumentada": la experiencia del SAV de la Universidad de Sevilla. *International Journal of Educational Research and Innovation (IJERI)*, 6, 110-123.
- Cabero, J., Leiva, J. J., Moreno, N. M., Barroso, J., & López-Meneses, E. (2016). *Realidad Aumentada y educación. Innovación en contextos formativos*. Barcelona: Octaedro.
- Cabero, J., & Marín, V. (2018). Blended learning y realidad aumentada: experiencias de diseño docente. *Revista Iberoamericana de Educación a Distancia*, *21*(1), 57-74.
- Cabero, J., Vázquez, E., & López, E. (2018). Uso de la Realidad Aumentada como recurso didáctico en la enseñanza universitaria. *Formación universitaria*, *11*(1), 25-34.
- Corral, Y. (2009). Validez y confiabilidad de los instrumentos de investigación para la recolección de datos. *Revista Ciencias de la Educación, 19*(33), 228-247.
- Cubillo, J., Martín, S., Castro, M., & Colmenar, A. (2014). Recursos digitales autónomos mediante realidad aumentada. *RIED. Revista Iberoamericana de Educación a Distancia*, *17*(2), 241-274.
- De la Horra, G. (2017). Realidad aumentada, una revolución educativa. *EDMETIC*, *6*(1), 9-22.
- De la Torre, J., Martín, N., Saorín, J. L., Carbonell, C., & Contero, M. (2013). Entorno de aprendizaje ubicuo con realidad aumentada y tabletas para estimular la comprensión del espacio tridimensional. *Revista de Educación a Distancia*, (37), 1-17.
- Escobar, J., & Cuervo, A. (2008). Validez de contenido y juicio de expertos: una aproximación a su utilización. *Avances en medición, 6*(1), 27-36.
- Fernández, B. (2018). La utilización de objetos de aprendizaje de realidad aumentada en la enseñanza universitaria de Educación Primaria. *IJERI: International Journal of Educational Research and Innovation*, (9), 90-104.
- Fombona, J., Pascual, M. A., & González, M. (2017). M-learning y realidad aumentada: Revisión de literatura científica en el repositorio WoS. *Comunicar*, *25*(52), 63-72.
- Forés, A., Sánchez, J. A., & Sancho, J. (2014). Salir de la zona de confort. Dilemas y desafíos en el EEES. *Tendencias pedagógicas* (23), 205-215.
- García, F., Alfaro, A., Hernández, A., & Molina, M. (2006). Diseño de Cuestionarios para la recogida de información: metodología y limitaciones. R*evista Clínica de Medicina de Familia, 1*(5), 232-236.
- Hernández, R., Fernández, C., & Baptista, M. P. (2014). *Metodología de la investigación.* Madrid: McGraw Hill.
- Huertas, A., & Pantoja, A. (2016). Efectos de un programa educativo basado en el uso de las TIC sobre el rendimiento académico y la motivación del alumnado en la asignatura de tecnología de educación secundaria. *Educación XX1*, *19*(2), 229-250.
- Jódar, J. (2010). La era digital: Nuevos medios, nuevos usuarios y nuevos profesionales. *Razón y Palabra, 15*(71), 1-11.
- Landero, R., & González, M. (2006). *Estadística con SPSS y metodología de la investigación.* México: Trillas.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), 12, 122-136
ISSN: 2386-4303

- Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa. *Boletín Oficial del Estado*. Madrid, 10 de diciembre de 2013, núm. 295, 1-64.
- López, J. (2017). El fenómeno del liderazgo en los centros de enseñanza de naturaleza cooperativa. En Alcántara, J.M., Bermúdez, M., Blanco, F.J., & Heredia, J.M. (Eds.), *Investigación e innovación en el ámbito universitario. Tendencias ante los retos actuales de la sociedad* (pp. 37-46). Madrid: EOS.
- López, J., Fuentes, A., & Moreno, A. J. (2018). El liderazgo efectivo en los centros concertados de naturaleza cooperativa: Percepciones de sus docentes. *Revista actualidades investigativas en educación, 18*(3), 1-21.
- López, J., Moreno, A. J., & Pozo, S. (2018). Influencia del género y la edad en la formación continua multidisciplinar de los docentes de cooperativas de enseñanza. *Revista Innova, 3*(8), 42-59.
- López, J., & Fuentes, A. (2018). El liderazgo aplicado a los modelos diferenciados en educación: El caso de las cooperativas de enseñanza. En Gairín, J., & Mercader, C. (Eds.), *Liderazgo y gestión del talento en las organizaciones* (pp. 169-175). Madrid: Wolters Kluwer.
- Maquilón, J. J., Mirete, A. B., & Avilés, M. (2017). La Realidad Aumentada (RA). Recursos y propuestas para la innovación educativa. *Revista Electrónica Interuniversitaria de Formación del Profesorado*, *20*(2), 183-204.
- McMillan, J. H. & Schumacher, S. (2005). *Investigación educativa*. Madrid: Pearson.
- Méndez, J., & Delgado, M. (2016). Las TIC en centros de Educación Primaria y Secundaria de Andalucía. Un estudio de casos a partir de buenas prácticas. *Digital Education Review*, (29), 134-165.
- Montijano, M. P. & De Esteban, J.M. (2017). Cómo el uso de las TIC contribuye a mejorar la gestión del aula: estudio de un caso. En Ruiz, J., Sánchez, J. y Sánchez, E. (Eds). *Innovación docente y uso de las TIC en educación* (pp. 1-12). Málaga: UMA Editorial.
- Moreno, N. M., Leiva, J. J., & López, E. (2016). Experiencia formativa en el uso didáctico de la realidad aumentada con estudiantes del máster de formación del profesorado en educación secundaria en la Universidad de Málaga. *Innovación Educativa, 26,* 265-303.
- Moreno, N. M., Leiva, J. J., & Matas, A. (2016). Mobile learning, Gamificación y Realidad Aumentada para la enseñanza-aprendizaje de idiomas. *IJERI: International Journal of Educational Research and Innovation*, (6), 16-34.
- Ortega, I. (2009). La alfabetización tecnológica. *Teoría de la Educación. Educación y Cultura en la Sociedad de la Información, 10*(2), 11-24.
- Ramírez, M., & García, F. (2017). La integración efectiva del dispositivo móvil en la educación y en el aprendizaje. *RIED. Revista Iberoamericana de Educación a Distancia, 20* (2), 29-47.
- Real Decreto 1105/2014, de 26 de diciembre, por el que se establece el currículo básico de la Educación Secundaria Obligatoria y del Bachillerato. *Boletín Oficial del Estado*. Madrid, 3 de enero de 2015, núm. 3, 169-546.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), 12, 122-136
ISSN: 2386-4303

- Sánchez, A., & Castro, D. (2013). Cerrando la brecha entre nativos e inmigrantes digitales a través de las competencias informáticas e informacionales. *Apertura, 5*(2), 6-15.
- Sánchez, J. M., & Toledo, P. (2017). Tecnologías convergentes para la enseñanza: Realidad Aumentada, BYOD, Flipped Classroom. *RED. Revista de Educación a Distancia*, (55), 1-15.

Fecha de recepción: 12-10-2018 Fecha de aceptación: 31-05-2019
López-Belmonte, J., Pozo-Sánchez,S. & Fuentes-Cabrera, A. (2019). Recursos tecno-pedagógicos de apoyo a la docencia: La realidad aumentada como herramienta dinamizadora del profesor sustituto
International Journal of Educational Research and Innovation (IJERI), *12*, 122-136
ISSN: 2386-4303