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Mobile Learning in Pre-Service Teacher Education: Perceived Usefulness of AR Technology in Primary Education

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Abstract: Mobile learning is a resource that can enhance the teaching-learning process of students and improve the training of future teachers. Specifically, augmented reality (AR) technology allows for immersive and experiential learning without the need to leave the classroom. The purposes of this paper were to apply AR technology in the training of future Primary Education teachers and to analyze the perceived usefulness of AR in the classroom by future teachers. A quantitative approach was used based on a design with a control group and two experimental groups with a post-test using a sample of 171 second-year students studying an education degree. The results showed that experimentation with AR promoted a slight increase in student motivation. However, no significant differences were found between the control group and the experimental groups. Finally, the findings allowed us to establish that the implementation of resources such as AR does not differ in the opinion of future teachers about the inclination to implement AR in the classroom.

Keywords: mobile learning; augmented reality; teacher training; mobile devices; higher education

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1. Introduction

Mobile computing is revolutionizing all sectors. In the education sector, technology has been an important issue for several decades. In this sense, the Horizon Reports annually highlight the emerging technologies with the greatest short, medium and long term impact on Higher Education [1,2], at the same time as the European 2020 strategy dictates the need to train university students in digital skills [3].

Among the learning technologies with the greatest impact, the 2019 Horizon Report states that, in the medium term, mixed reality will be implemented at the higher education stage [4]. Mixed reality encompasses both virtual reality (VR) and augmented reality (AR), being that technology that allows the combination of elements of the real world with virtual elements generated by a mobile device [5]. Although VR and AR have great potential for student learning, AR has been more developed in Higher Education, primarily because its implementation costs are lower than those of VR [6]. AR can be used directly with a mobile device, brought by the student himself—this strategy has been called "bring your own device" (BYOD) within mobile learning [7]—while, to use the VR, it is necessary to have an additional viewer.

Specifically, working with AR in the classroom allows for immersive and experiential learning in students [8]. This results in a number of benefits of AR such as the development of digital skills [9,10], increased motivation [11–13], and improved academic performance [14,15].

This development of digital skills is related to the development of digital teaching competence [16], directly impacting on areas such as digital content creation and problem-solving with technology, which are essential dimensions for teachers to successfully apply technology in the classroom [17].

However, there are some obstacles to incorporating AR in the university training of future teachers, among which the following stand out: the lack of teacher training; the scarcity of AR educational experiences; the little educational research on its applicability and the limited resources available to the institutions [18]. Despite this, university professors are beginning to implement AR more and more frequently [19,20]. This is key to the training of future teachers since younger teachers tend to implement methodologies based on learning technologies such as AR [21].

On the other hand, some experiences of applying AR in schools show amazing results. For example, a mobile system based on AR was used for learning chemistry in secondary education which greatly stimulated students' understanding and retention of learning, while increasing their motivation [22]. Other experiences, located in primary education, showed that AR contributed to improved learning, motivation and the understanding of concepts [23–25].

Along the lines of this study, other previous works have been carried out where AR has been applied with future teachers. The following results were obtained: improved learning and favorable attitude towards the use of AR applications by future teachers [26]; improved understanding, motivation and creativity [27]; positive perception of the use of AR in education [28]; increased motivation and improved learning [29]; high predisposition to use AR in the future [30]; and increased creativity, innovation, participation and motivation of students [31].

For all these reasons, it is essential to apply technologies to improve learning, and even more so in the training of future teachers so that they can experience the virtues and functions of AR in order to have the opportunity to apply it in the future. Based on these premises, the objectives of the study were set as follows: (i) to apply AR technology in the training of future Primary Education teachers, and (ii) to analyze the perceived usefulness of AR in the classroom by future teachers. From these objectives, the following research questions were derived:

RQ1. Does AR increase the learning motivation of future teachers?

RQ2. Does previous experimentation with AR influence the subsequent implementation of technological resources in the classroom by future teachers?

RQ3. Are there significant differences in the perceived usefulness of AR among future teachers who have experienced it and those who have not?

2. Methodology

This study has been developed at a quantitative level through a descriptive and correlational approach [32]. Two types of groups (control and experimental) have been established to compare the influence of AR on study variables for a single student population. The difference stipulated between the two groups has been methodological [33]. Thus, the control group has received training, without using AR. Instead, the experimental groups followed an active methodology, where AR was implemented as a learning technology. The use of the AR was configured as an independent variable and the dimensions collected by the instrument applied were configured as dependent variables.

2.1. Research Design and Participants

A descriptive approach has been adopted with 171 second-year students studying for a Primary Education Degree. For this type of research, the sample size is not an influential factor in making comparisons from a single student population [34]. The research was conducted based on a convenience sampling design. Specifically, the study sample was composed of 55 men and 116 women ranging in age from 18 to 58 (M = 20.26; SD = 3.67). This is common in education degrees in Spain, where the female population is much larger than the male population [35].

The participants were grouped into three study groups: two of an experimental nature and one of a control nature. Treatment allocation was established on a randomized basis. Therefore, a design with two experimental groups, one control group and a post-test was adopted (Table 1). Although no pretest was done to check the groups' starting level, the groups were comparable since they belonged to the same academic level, course and degree.

Table 1. Research design.

Group	*n*	Composition	Pretest	Treatment	Post-Test
Experimental 1	49	Natural	–	X	O_1
Experimental 2	59	Natural	–	X	O_2
Control	63	Natural	–	–	O_3

Note: Treatment was randomly assigned.

The duration of the experience was two 1-hour sessions. In the case of the control group, a theoretical explanation was given about AR, its characteristics and operation. Videos were shown on how this resource is implemented in classrooms (the videos were created for this experience). Mainly, the didactic utility was emphasized through the visualization of examples in which it was observed how AR content works with primary education students.

In contrast, in the case of the experimental groups, a deductive approach was taken in which students were introduced to the mobile application (app) "Metaverse". The students had to design a didactic proposal, contextualized for a primary education course, in which they would make use of this tool. The use of a discovery methodology was advocated as it was not intended to influence students in the creation of their designs. Finally, the students proceeded to present the developed activity, the selected primary education knowledge area, and the visualization of AR through their mobile devices was carried out.

The data were collected during the 2019/2020 academic year in the subject of didactic and technological resources applied to primary education in the second year of the University Degree in Primary Education at the University of Granada (Spain). Before answering the scale, participants gave their informed consent.

2.2. Measure

Responses were collected through an ad hoc questionnaire on perceptions of AR. For its configuration, the Everyday Technology Use Questionnaire: ETUQ [36], was taken as a reference. The instrument consisted of 20 items grouped in four dimensions: Perceived usefulness (PU) (items 1–5), Difficulty of AR use (DIF) (items 6–10), Motivation (MOT) (items 11–15) and future use of technological resources (FUT) (items 16–20). According to the typology of the instrument, it is a four-level Likert-type scale (1 = Completely disagree; 2 = Disagree; 3 = Agree; 4 = Completely agree). The following socio-demographic data issues were added to these 20 items: gender, age and class group.

The questionnaire was subjected to a process of content validation by expert judgment, composed of various doctors from different Spanish universities (University of Granada, University of Seville and University of Malaga). In addition, the Kaiser-Meyer-Olkin measurement was calculated for sampling adequacy (KMO = 0.804) and the Bartlett sphericity test (χ^2 = 964.153; df = 190; p-value = 0.000). Finally, regarding the internal consistency of the instrument, Cronbach's Alpha test was applied, which obtained a result of α = 0.911, an optimal value to guarantee the viability of the research.

2.3. Data Analysis

As regards data processing, they were analyzed using the SPSS v.25 statistical software and the AMOS v.24 statistical package. In the first instance, descriptive statistics were calculated to allow a first approach to the responses given by the different samples. Subsequently, the focus was on establishing a comparison between the means obtained in the different treatment groups through the application of the ANOVA test and the T-test, after checking the normality and character of the set of variances through the Shapiro-Wilk and Levene tests. Finally, the existing correlations between the dimensions of the instrument were analyzed, in order to check if there were proportional relations that could be significant.

3. Results

The results of the descriptive analysis showed the groups that experimented with AR presented slightly higher results than those that received the traditional methodology. This is reflected in the different coefficients shown by arithmetic means (Table 2). It can also be seen that there are small differences from the averages obtained between the two experimental groups. Regarding the variability of the responses, this is not very high, so the presence of outliers that could cause a distortion of the means is ruled out.

Table 2. Descriptive statistics.

Dimension		Statisticals			
	Group	Mean	SD	S_{kw}	K_{me}
PU	C	3.37	0.617	−0.477	−0.627
	E_1	3.44	0.580	−0.405	−1.203
	E_2	3.24	0.607	−0.129	−0.707
DIF	C	2.20	0.695	0.343	0.246
	E_1	2.28	0.702	0.454	1.30
	E_2	2.26	0.727	0.568	0.991
MOT	C	3.02	0.647	−1.463	−0.044
	E_1	3.12	0.632	−1.891	0.462
	E_2	3.05	0.587	−0.199	−0.613
FUT	C	3.36	0.594	−0.424	0.079
	E_1	3.45	0.535	−0.120	−1.099
	E_2	3.29	0.576	−0.152	0.115

Note: C = Control group; E_1 = Experimental group 1; E_2 = Experimental group 2; PU = Perceived usefulness; DIF = Difficulty; MOT = Motivation; FUT = Future applicability.

Regarding the comparison of the groups, the T-test indicated that there were no significant differences between them: Control group (M = 49.81; SD = 4.13); Experimental groups (M = 49.93; SD = 3.86) (p-value = 0.849). At the same time, the difference between the averages of each group for each dimension was minimal (Figure 1). Even in PU the average of the control group was slightly higher than that of the experimental groups.

As this is a study involving three treatment groups, the application of the ANOVA test was chosen in order to check whether there were significant differences between the means of the different distributions. Prior to this, the Shapiro-Wilk test was applied to check the normality of the data trends (p-value > 0.05), as well as the Levene test that guaranteed the existence of a homogeneity of variances in the presented data (p-value > 0.05).

Once this was verified, the application of the ANOVA test allowed us to see if there were significant differences in the perceived utility dimension between the means of the different treatment groups (Table 3). However, in the other dimensions, the same casuistry was not perceived.

For the dimension of perceived utility, the Tukey post-hoc test was applied (Table 4), which allowed us to know in which groups differences in means were located. These were found in the two experimental groups with respect to the control. In the other dimensions, no differences in averages were observed that obtained significant values.

Finally, Table 5 presents the correlation results, as well as the measures of central tendency and dispersion obtained in the analysis of the variables. Correlations with significant values were established between the dimensions PU and MOT, PU and FUT, MOT and FUT (p-value < 0.001). On the other hand, it was also observed that the asymmetry statistics were below two (PU = −0.232, DIF = 0.872, MOT = −0.171, FUT = 0.210), and the kurtosis results below seven (PU = −0.493, DIF = 1.325, MOT = −0.325, FUT = −0.786), this indicated that the principles of multivariate normality were met [37].

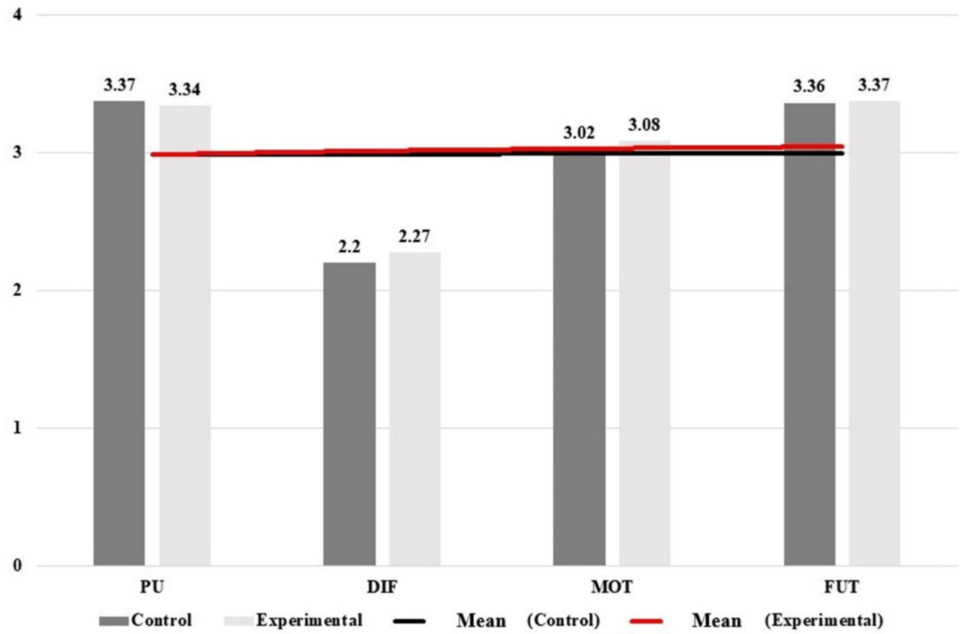

Figure 1. Mean difference between control and experimental groups. Note: PU = Perceived usefulness; DIF = Difficulty; MOT = Motivation; FUT = Future applicability.

Table 3. ANOVA according to the treatment group.

		Squares Sum	df	Mean Square	F	*p*
PU	Between groups	29.065	2	14.533	4.615	0.011
	Within groups	529.080	168	3.149		
	Total	558.145	170			
DIF	Between groups	7.799	2	3.899	1.196	0.305
	Within groups	547.751	168	3.260		
	Total	555.549	170			
MOT	Between groups	4.231	2	2.116	1.024	0.361
	Within groups	342.855	166	2.065		
	Total	347.086	168			
FUT	Between groups	11.076	2	5.538	2.110	0.124
	Within groups	435.703	166	2.625		
	Total	446.779	168			

Table 4. Tukey's mean difference test.

Variable	Group	Comparative Group	Mean Difference	SD
PU	E_1	E_2	0.98796 *	0.343
		C	0.26803	0.338
	E_2	E_1	−0.98796 *	0.343
		C	−0.71994	0.321
	C	E_1	−0.26803	0.338
		E_2	0.71994	0.321

Table 4. *Cont.*

DIF	E_1	E_2	0.43085	0.349
		C	0.50204	0.343
	E_2	E_1	−0.43085	0.349
		C	0.07119	0.327
	C	E_1	−0.50204	0.343
		E_2	−0.07119	0.327
MOT	E_1	E_2	0.32020	0.278
		C	0.36959	0.274
	E_2	E_1	−0.32020	0.278
		C	0.04939	0.262
	C	E_1	−0.36959	0.274
		E_2	−0.04939	0.262
FUT	E_1	E_2	0.63390	0.313
		C	0.25574	0.310
	E_2	E_1	−0.63390	0.313
		C	−0.37816	0.295
	C	E_1	−0.25574	0.310
		E_2	0.37816	0.295

Note: C = Control group; E_1 = Experimental Group 1; E_2 = Experimental Group 2; * $p < 0.05$.

Table 5. Correlation between the variables and descriptive statistics.

Variables	1. PU	2. DIF	3. MOT	4. FUT
1. PU	1			
2. DIF	0.323	1		
3. MOT	0.698 ***	0.415	1	
4. FUT	0.803 ***	0.309	0.753 ***	1
Average	13.80	9.36	12.64	14.07
Standard Deviation	1.81	1.80	1.43	1.63
Skewness	−0.232	0.872	−0.171	0.210
Kurtosis	−0.493	1.325	−0.325	−0.786

Note: $n = 171$, *** $p < 0.001$.; PU = Perceived usefulness; DIF = Difficulty; MOT = Motivation; FUT = Future applicability.

4. Discussion

The use of technological resources is postulated as one of the emerging trends in Higher Education today. The arrival of tools such as AR has had an impact on the educational community, due to their didactic usefulness. Effective use of these resources will undoubtedly promote an improvement of the current practice in the classrooms, which will allow us to attract more students' attention towards the teaching subjects. As a result of this idea, the present study aimed to test whether experimentation with AR has a real influence on student motivation. As well as measuring whether the experimentation with this type of resource encouraged receptive attitudes towards the future applicability of technological resources on the part of the students, and whether these were different from those students who were not participants in the experience.

In this line, data showed that experimentation with AR promoted a slight increase in student motivation. In this sense, we continue in the line of research on contrasting experiences about the application of AR and the increase in student motivation rates [27,29]. Furthermore, both the control group and the experimental groups agreed that the operation of this resource is not an obstacle to its future applicability. With regard to this aspect, and in view of the many studies that highlight the problem of the low level of digital teaching skills seen in today's teachers, the need to implement good practices with technological resources becomes a necessity for higher education teachers [16]. Based on previous studies, this experience reflects the importance of the implementation of AR to elucidate the possible didactic paths of AR in primary education classrooms [18]. With the procedure exercised in this experience, it has been intended that students do not limit themselves to imitating a certain example but that, through discovery, they can create their own digital content, thus improving skills such as creativity and the ability to innovate [31].

On the other hand, despite the fact that not all students participated in the experimentation, the research yielded surprising results regarding the perceived utility towards AR by the control group, which showed slightly more favorable rates than the experimental groups. This result allows us to analyze the idea about the power of capture that AR has been able to provoke in the students of this group, and of the didactic possibilities that they find in it. There is no doubt that, in the current context, technology has a great power to attract young people and, therefore, introducing it into the classroom in a responsible manner and with pedagogical objectives can facilitate the teaching-learning process [26].

The application of the T-test corroborated the previous idea, stating that there were no significant differences between the means of the control group and the experimental groups. Therefore, despite the practice experienced by the students of the experimental sets, and as well as the slight improvement shown in the previous analysis, it is not sufficient to be able to extrapolate it as significant. However, the ANOVA analysis allowed us to locate significant differences between the means of the two experimental groups regarding the perceived utility towards AR. To elucidate this question, the results obtained in Tukey's test allowed us to conclude that at least one of the variables of perceived utility presented differential means in the two groups that carried out the practical experience. Therefore, and in response to the question raised by the study, previous experimentation with AR has not had a significant influence on students' attitudes towards the future applicability of technological resources. This idea has turned out to be contrary to that inferred by other studies [30].

Finally, the correlative analysis extracted some relationships between the sets of variables that made up the study, such as the strong link observed between perceived utility and future applicability. These are variables that undoubtedly increase the importance of teachers providing new and useful resources that attract the attention of students. Similarly, the high level of correlation obtained between future applicability and motivation, as well as between motivation and perceived usefulness towards AR, made it possible to corroborate this idea and to emphasize the link between functional education and the motivation index [31].

5. Conclusions

The implementation of technological resources in higher education classrooms is beginning to be consolidated as a practice that improves student motivation. Through this paper, we have tried to continue strengthening the path towards educational innovation within the classrooms, betting on an education that is updated to the current context from the application of mobile computing.

The results of this research made it possible to determine that the implementation of resources such as AR does not differ in their perception (RQ1). Likewise, future teachers involved in research have perceived in the AR a powerful resource whose didactic usefulness is considerable (RQ2). In this way, they present a favorable attitude to the applicability of technological resources in the near future, although no significant differences were found between groups (RQ3).

Regarding the limitations of the study, firstly, there is the course of practical experience, which could have been greater, but the density of the subject did not allow the duration to be extended. In addition, the selection criteria of the students who made up the treatment groups were established by the authors by convenience sampling. As for future lines of research, it is advocated to continue sharing experiences of good teaching practices with mobile devices to compile a solid body of research that favors the measurement of the size of the overall effect, to check its true effectiveness.

In conclusion, the line of work that aims to carry out the integration of learning technologies in the Higher Education stage should be continued. Specifically, mobile learning is an opportunity to advance teaching and learning, since future teachers find mobile devices attractive and show favorable attitudes towards teaching that incorporates these resources that they can later implement in the classroom. Furthermore, university administrators can organize training programs in emerging technologies for instructors on augmented reality, virtual reality and the use of mobile devices in the classroom, so that active ICT training policies are generated, with the aim of training university teachers and providing the institution with resources. Thus, it will be possible to advance in the technological development of schools and society. In turn, data is collected in this study with which teachers could consider the AR applied in the classroom, without having previously conducted experimentation with AR, as it has been shown that there is no difference in motivation and positive perception of students' previous use of AR.

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References

1. Adams, S.; Cummins, M.; Davis, A.; Freeman, A.; Hall, C.; Ananthanarayanan, V. *NMC Horizon Report: 2017 Higher Education Edition*; The New Media Consortium: Austin, TX, USA, 2017.
2. Adams, S.; Brown, M.; Dahlstrom, E.; Davis, A.; DePaul, K.; Díaz, V.; Pomerantz, J. *NMC Horizon Report: 2018 Higher Education Edition*; Educause: Louisville, CO, USA, 2018.
3. Reyes, A.E. Education and training in the European Union: Analysis of the Bologna process, the European Higher Education Area, the Europe 2020 strategy and the Erasmus+ programme. *Derecho Cambio Soc.* **2015**, *12*, 1–23. [CrossRef]
4. Alexander, B.; Ashford-Rowe, K.; Barajas-Murphy, N.; Dobbin, G.; Knott, J.; McCormack, M.; Pomerantz, J.; Seilhamer, R.; Weber, N. *EDUCAUSE Horizon Report: 2019 Higher Education Edition*; Educause: Louisville, CO, USA, 2019.
5. Moreno, N.M.; Leiva, J.J.; Matas, A. Mobile learning, Gamification and Augmented Reality for the teaching and learning of languages. *IJERI* **2016**, *6*, 16–34.
6. Vasilevski, N.; Birt, J. Analysing construction student experiences of mobile mixed reality enhanced learning in virtual and augmented reality environments. *Res. Learn. Technol.* **2020**, *28*, 2329. [CrossRef]
7. Romero-Rodríguez, J.M.; Trujillo-Torres, J.M.; Rodríguez-García, A.M. Bring Your Own Device to the Classroom: Uses of the Mobile Phone for the University Training. *TOJED. Turk. Online J. Educ. Technol.* **2018**, *1*, 254–260.
8. Hinojo-Lucena, F.J.; Aznar-Díaz, I.; Cáceres-Reche, M.P.; Romero-Rodríguez, J.M. Opinion of Future Primary Education Teachers on the Implementation of Mobile Learning in the Classroom. *Educ. Electron. J.* **2019**, *23*, 1–17. [CrossRef]
9. Fuentes-Cabrera, A.; López-Belmonte, J.; Pozo-Sánchez, S. Analysis of the Digital Teaching Competence: Key Factor in the Performance of Active Pedagogies with Augmented Reality. *REICE* **2019**, *17*, 27–42. [CrossRef]
10. Frydenberg, M.; Andone, D. Enhancing and transforming global learning communities with augmented reality. *J. Inf. Syst. Educ.* **2018**, *29*, 37–44.
11. Cabero, J.; Fernández, B.; Marín, V. Mobile devices and augmented reality in the learning process of university students. *RIED Rev. Iberoam. Educ. Distancia* **2017**, *20*, 167–185. [CrossRef]
12. Gómez-García, G.; Rodríguez-Jiménez, C.; Marín-Marín, J.A. The transcendence of Augmented Reality in student motivation. A systematic review and meta-analysis. *Alteridad Rev. Educ.* **2020**, *15*, 36–46. [CrossRef]

13. Rodríguez-García, A.M.; Hinojo-Lucena, F.J.; Ágreda-Montoro, M. Design and implementation of an educational project on interculturality in early childhood education using augmented reality and QR codes. *Educar* **2019**, *55*, 59–77. [CrossRef]
14. Ericson, M.; Chen, A.; Taketomi, T.; Yamamoto, G.; Miyazaki, J.; Kato, H. Augmented Reality Learning Experiences: Survey of Prototype Design and Evaluation. *IEEE Trans. Learn. Technol.* **2014**, *7*, 38–56. [CrossRef]
15. Pellas, N.; Fotaris, O.; Kazandis, I.; Wells, D. Augmenting the learning experience in primary and secondary school education: A systematic review of recent trends in augmented reality game based learning. *Virtual Real.* **2019**, *23*, 329–346. [CrossRef]
16. Instefjord, E.J.; Munthe, E. Educating digitally competent teachers: A study of integration of professional digital competence in teacher education. *Teach. Teach. Educ.* **2017**, *67*, 37–45. [CrossRef]
17. Spanish National Institute of Educational Technologies and Teacher Training (INTEF). *Common Framework for Digital Educational Competence*; Ministry of Education, Culture and Sport: Madrid, Spain, 2017. [CrossRef]
18. Barroso-Osuna, J.; Gutiérrez-Castillo, J.J.; Llorente-Cejudo, M.C.; Valencia, R. Difficulties in the Incorporation of Augmented Reality in University Education: Visions from the Experts. *NAER* **2019**, *8*, 126–141. [CrossRef]
19. MOTIV-e European Project: Methods, Tools, and Resources for Efficient and Engaging ICT-Enhanced Teaching within VET Erasmus+ EU Programme, Contact No. 2020-1-PL01-KA202-082180. Available online: http://motiv-e.eu/ (accessed on 17 May 2020).
20. Villalustre, L. Methodological proposal for the didactic integration of augmented reality in Early Childhood Education. *EDMETIC* **2020**, *9*, 170–181. [CrossRef]
21. López-Belmonte, J.; Pozo-Sánchez, S.; Fuentes-Cabrera, A.; Romero Rodríguez, J.M. Uses and integration of Augmented Reality in the Educational Cooperatives of Andalusia (Spain). *J. Technol. Sci. Educ.* **2020**, *10*, 4–16. [CrossRef]
22. Cen, L.; Ruta, D.; Mohd, L.M.; Ng, J. Augmented Immersive Reality (AIR) for Improved Learning Performance: A Quantitative Evaluation. *IEEE Trans. Learn. Technol.* **2020**, *13*, 283–296. [CrossRef]
23. Demitriadou, E.; Stavroulia, K.E.; Lanitis, A. Comparative evaluation of virtual and augmented reality for teaching mathematics in primary education. *Educ. Inf. Technol.* **2020**, *25*, 381–401. [CrossRef]
24. Khan, D.; Rehman, I.; Ullah, S.; Ahmad, W.; Cheng, Z.; Jabeen, G.; Kato, H. A Low-Cost Interactive Writing Board for Primary Education using Distinct Augmented Reality Markers. *Sustainability* **2019**, *11*, 5720. [CrossRef]
25. Sáez-López, J.M.; Sevillano-García, M.L.; Pascual-Sevillano, M.A. Application of the ubiquitous game with augmented reality in Primary Education. *Comunicar* **2019**, *27*, 71–82. [CrossRef]
26. Díaz-Noguera, M.D.; Toledo-Morales, P.; Hervás-Gómez, C. Augmented Reality Applications Attitude Scale (ARAAS): Diagnosing the Attitudes of Future Teachers. *New Educ. Rev.* **2017**, *50*, 215–226. [CrossRef]
27. Fuchsova, M.; Korenova, L. Visualisation in Basic Science and Engineering Education of Future Primary School Teachers in Human Biology Education Using Augmented Reality. *Eur. J. Contemp. Educ.* **2019**, *8*, 92–102. [CrossRef]
28. Moreno, N.M.; Leiva, J.J. Formative experiences in the educational use of augmented reality with students of primary education degree at the University of Malaga. *Edmetic* **2017**, *6*, 81–104. [CrossRef]
29. Pedraza, C.E.; Amado, O.F.; Lasso, E.; Munévar, P.A. The experience of augmented reality (AR) in teacher training at the Universidad Nacional Abierta y a Distancia UNAD Colombia. *Píxel-Bit* **2017**, *51*, 111–131. [CrossRef]
30. Roig-Vila, R.; Lorenzo-Lledó, A.; Mengual-Andrés, S. Perceived usefulness of augmented reality as a didactic resource in the Infant Education Teacher degree. *Campus Virtuales* **2019**, *8*, 19–35.
31. Sáez-López, J.M.; Cózar-Gutiérrez, R.; González-Calero, J.A.; Gómez, C.J. Augmented Reality in Higher Education: An Evaluation Program in Initial Teacher Training. *Educ. Sci.* **2020**, *10*, 26. [CrossRef]
32. Hernández, R.; Fernández, C.; Baptista, P. *Research Methodology*, 6th ed.; McGraw-Hill: Mexico City, Mexico, 2016.
33. Moreno-Guerrero, A.J.; Romero-Rodríguez, J.M.; López-Belmonte, J.; Alonso-García, S. Flipped Learning Approach as Educational Innovation in Water Literacy. *Water* **2020**, *12*, 574. [CrossRef]
34. Chou, P.N.; Feng, S.T. Using a Tablet Computer Application to Advance High School Students' Laboratory Learning Experiences: A Focus on Electrical Engineering Education. *Sustainability* **2019**, *11*, 381. [CrossRef]
35. Aznar-Díaz, I.; Hinojo-Lucena, F.J.; Cáceres-Reche, M.P.; Trujillo-Torres, J.M.; Romero-Rodríguez, J.M. Environmental Attitudes in Trainee Teachers in Primary Education. The Future of Biodiversity Preservation and Environmental Pollution. *Int. J. Environ. Res. Public Health* **2019**, *16*, 362. [CrossRef]
36. Nygård, L.; Rosenberg, L.; Kottorp, A. *Everyday Technology Use Questionnaire (ETUQ)*; Unpublished Manual, Research Version, 2; Karolinska Institutet: Stockholm, Sweden, 2008.
37. Curran, P.J.; West, S.G.; Finch, J.F. The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychol. Methods* **1996**, *1*, 16–29. [CrossRef]