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Study on Parents' Acceptance of the Augmented Reality Use for Preschool Education

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Abstract

Parental influence on children's development is commonly accepted as essential, while the way how parents affect preschool students' information and communication technology (ICT) use at school needs a further exploration. This exploratory study is aimed to contribute to a better understanding of parental influence on children's Augmented Reality (AR) use at preschool education by analyzing interview data collected from parents whose children have worked at school with both; AR didactical resources and traditional didactical resources. The study identified and organized parent´s perspective into five components: motivation, knowledge, reading and writing, creativity and degree of satisfaction. The relationships among these components were often complex with intriguing similarities and differences among the participants. According to parents, the findings suggest that there are a lot of benefits in using a technological competitive tool based on AR: the integration of several components in order to achieve a common goal, the possibility of managing the execution of the exercises in several contexts, or the system availability.

Keywords: Parental perspectives; augmented reality; preschool students; knowledge; degree of satisfaction.

1. Introduction

Based on the assumption that the benefits of ICT for education are considerable, many tools exist that try to provide students an effective use of ICT. Over the last few years much of the effort in the educational ICT area

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has been devoted to addressing the issue of equity and equality [1, 2]. There is an increasing amount of literature concerning ICT use in education across all domains in life, including outside school or informal learning contexts [3, 4]. Although it has been noted in the literature that the environment within which the technology is used could be related to the learning outcomes [5], ICT-mediated education should be viewed as a whole and should take broader social or cultural contexts into consideration such as the family and home factors [6, 7].

This research focuses in ICT, specifically in Augmented Reality. It is aimed to compare data obtained from interviews with parents whose children worked under two different conditions, that is, children who used AR didactical resources, and children who used traditional didactical resources; and attempted to contribute to investigate AR effects in preschool education from parents' perspective.

The research questions were as follow:

- How does using AR can motivate your child in the learning process?
- Do you believe that your child have acquired more knowledge using AR than using traditional methods?
- Did you observe a significant progress in your child's reading and writing process after using AR?
- Does AR spark creativity in your children?
- What is your degree of satisfaction related to your child´s achievements after using AR?

2. Literature Review

In the literature, students' use of ICT, and personal and family inducements have been separately studied, but the interrelationships between the two have seldom been discussed. In this paper, we focus on AR as an advanced ICT which allows the user to interact with virtual and real world in a real time application, providing a natural experience and raising student attention and motivation. Summarizing, AR seems as a technology with a high potential to enhance the learning experience.

Augmented Reality is a technology which introduces virtual contents such as 3D computer-generated objects, texts and sounds, onto real images and video all in live time. There are different definitions and classifications of AR: Azuma [8] describes AR as a variation of Virtual Reality (VR), a technology which consists of the complete immersion of a user inside a synthetic environment. In VR the user is not able to perceive the surrounding real world. However, in AR it is possible. In this fact AR differs from VR, because AR adds artificial information to reality while it does not hide the surrounding real world.

Augmented Reality has been touted as one of the most interesting emergent technologies for education, being a powerful and motivating tool which can involve several senses of the student by means of the proper combination of sound, sight and touch. Application of AR technology in education is just beginning to be explored, especially when using it with preschoolers.

AR contributes in many ways to support the teaching/learning process: students' senses are involved in interactive activities by using manipulative material [9]. Besides, self-learning is promoted by enjoyable edutainment in friendly interfaces [10, 11]. And from the point of view of technology approval, in previous studies it has been showed that students and their parents have made positive valuations about AR [12].

An important point arises from using ICT, specifically AR, it is the fact that family environment factors affect to students' ICT use. There is a widely agreed concept that students' educational attainment achievements are always supported by their families and that is what we want to find out with this research. Parents, who, of course, want their children to be able to prosper, are some of the greatest boosters of ICTs. Parents usually associate ICTs with educational achievement and distinct advantages.

By the other hand, researchers have conducted many studies on various activities addressed to the issue of parental involvement, and they have concluded that there are three main facets on parental involvement: attitudinal components, behavioral aspects, and stylistic elements [13, 14]. The attitudinal components include parents' aspirations or expectations for their children's educational success; the behavioral aspects include

parents' assistance with homework or attendance at parent-teacher meetings; and the stylistic elements referred to parenting style or family interaction patterns. Regarding to behavioral aspects, most of the researches on parental involvement have investigated the impact over the children whose parents usually attend to home-school collaboration activities, as for example, in studies where effects of parents' participation of school related activities have been analyzed. In these studies, researches specially focused on the behavioral aspects of parental involvement with students' home-based ICT use, but not in parents' opinion about the use of ICT in the school, or specifically AR, which is the main objective of this research. It seems that not enough attention had been paid in the literature to parental perspective regarding to children's ICT use at school. It has been shown that parental involvement may be particularly beneficial for children when it is autonomy supportive, process focused, characterized by positive affection, or accompanied by positive beliefs. In contrast, parental involvement may be detrimental to children if it is controlling, person focused, characterized by negative affection, or accompanied by negative beliefs [14].

Parents' support could be a critical foundation for the successful implementation of an information technology curriculum to foster information literacy [15] since parents can influence their children's relationship with ICT, and also AR, by providing technology resources, creating learning opportunities and communicating their own values and aspirations about their children's ICT use [16]. This is congruent with the findings from psychology: it is through parents' beliefs and behaviors that family socioeconomic factors indirectly relate to children's academic achievement.

To sum up, the existing studies indicate that family background, especially the influence from parents, has an impact on children's ICT use in general, which in turn has an impact on education. However, studies describing those clusters of parental factors which affect to students who use AR as a learning tool at preschool are nonexistent. Therefore, it is quite apparent, that there is an interesting research field in the likely linkage between parental influences and children's use of ICT for educational purposes. The present research attempted to contribute to knowledge in this area.

3. Method

In this research, the intervention was done in a natural situation, without a random selection of groups, one group (the experimental group) received the intervention (augmented reality contents), and while the other group (the control group) does not use AR. Initial conditions for both groups were similar: each group was composed by 18 children between 4 and 5 years old. Moreover, both groups had had the same teachers in the previous year and they had also studied the same contents.

Besides, this experience has been developed using an active and communicative methodology. On the one hand, teachers were deeply implied providing feedback data about student experiences. On the other hand, preschool students worked properly following the didactic guides developed by participant teachers. The chosen didactics units for the two groups involved were "skeleton" "animals" and "houses of the world". Two versions of these didactic materials were created of each unit, and three different AR applications. The only difference between them was that the "experimental unit" provided the augmented reality resources. In this way both units have the same educational curriculum content, one with AR and one without it. Therefore the independent variable of this research was the presence of Augmented Reality as a didactic tool, from the perspective of parents.

3.1. Experimental design and method

The aim of the experiment was to evaluate effects over parents when their preschoolers use Augmented Reality as a tool to learn. In this research a nonequivalent group posttest-only [17] design has been chosen. Under this scheme, the experimental group consisted of several parents whose children received the

intervention (teaching using Augmented Reality contents), while the control group consisted of several parents whose children does not use AR on the learning process. The intervention was done in a natural situation, without a random selection of groups [18].

Initial conditions for both groups were similar, that is, both groups were composed by 68 parents of 36 children between 4 and 5 years old, both groups of students had the same teachers in the previous year and they had also studied the same contents. Besides, this experience has been developed using an active and communicative methodology. On the one hand, teachers were deeply implied providing feedback data about student experiences. On the other hand, preschool students worked properly following the didactic guides developed by participant teachers.

Table 1. Parents' evaluative questionnaire. Likert scale: SD (strongly disagree), D (disagree), A (agree) and SA (strongly agree).

Item	**Criteria**			
Motivation:				
My child expresses interest in attending to school	SD	D	A	SA
My child spontaneously understood what has happened in the classroom	SD	D	A	SA
My child talks at home about what he was doing at the school	SD	D	A	SA
Knowledge:				
My child apply what he learned in school at home	SD	D	A	SA
My child tend to remember the acquired knowledge	SD	D	A	SA
You ask your child about what he worked in school every day	SD	D	A	SA
Reading and writing:				
My child has improved his reading and writing level	SD	D	A	SA
You are satisfied with your child's reading and writing level	SD	D	A	SA
You consider that this way of working encourages your child reading and writing skills	SD	D	A	SA
Creativity:				
This way of working has encouraged my child's creativity	SD	D	A	SA
I think that creativity is important for my child overall development	SD	D	A	SA
Didactical resources provide the student a greater autonomy and thus they give him a way to improve his creativity	SD	D	A	SA
Degree of satisfaction:				
I am satisfied with the attention provided to my child by the teachers	SD	D	A	SA
New teaching method is more functional than traditional methods	SD	D	A	SA
Involving families in this experience is positive	SD	D	A	SA

Three didactic units have been worked by the students during the development of this research, using two different didactic material versions for each thematic unit, that is, "traditional units" and "experimental units" were created. So "experimental units" include AR resources as the main difference between the didactic materials. In this way, all units have the same educational curriculum content, but one of them includes AR resources and the other one does not do it. Therefore, Augmented Reality used as a didactic tool was the independent variable of this research. Experimental and control group assessment was performed using an evaluative questionnaire completed by parents (see Table 1). This questionnaire consisted of 15 items, grouped into five dimensions; motivation, knowledge, reading and writing, creativity and degree of satisfaction. Where

each item was checked according to the following categories: SD (Strongly Disagree), D (Disagree), A (Agree) and SA (Strongly Agree).

Table 2. Characteristics of families whose children have worked with AR

Sex			Age				
N	M	F	25 years or less	26-35 years	36-45 years	46-55 years	More than 55 years
32	16	16	1	14	14	3	0
Education level							
No studies		Graduate	High school		Training	Bachelor / Master degree	
6		7	7		8	4	
Current occupation							
Employee		Unemployed	Retired		Housework		
24		6	0		2		

Table 3. Characteristics of families whose children have worked without AR

Sex			Age				
N	M	F	25 years or less	26-35 years	36-45 years	46-55 years	More than 55 years
36	18	18	1	12	16	6	1
Education level							
No studies		Graduate	High school		Training	Bachelor / Master degree	
6		9	10		11	0	
Current occupation							
Employee		Unemployed	Retired		Housework		
34		0	1		1		

3.2. Participants

The research involved two groups of parents of eighteen preschoolers each one. Preschoolers' ages were between four and five years and they studied in the public school Virgen de los Desamparados in Orihuela (Spain). One group of parents was taken as the control group, while the other one was taken as the experimental group. Both groups were composed by parents of third graders from the second cycle of pre-primary education, according to the Spanish education system.

The school is located in a rural area. It is one of the seventeen technological pilot schools in the province of Alicante (Spain). The school is fully equipped with technological media and also has formed a team of teachers experienced in ICT, which works hard to improve the use of ICT in the classroom. Regarding the participating students' parents in our research, they know that their sons have been using ICT in the school since they were three years old.

Tables 2 and 3 show some sociological characteristics of families that have participated in this research.

Data show similar groups. Moreover, we find remarkable that the vast majority of family member is aged between 26 and 45 years, have a high school educational level and are currently working on.

4. Results

Data obtained from tables 1, 2 and 3 were analyzed in order to assess the effects over parents when their preschoolers use Augmented Reality as a tool to learn. Then this section will discuss the parents' degree of satisfaction with the use of AR as a learning tool, based on the five dimension questionnaire data analysis. The main purpose of this analysis is to validate AR didactical resources acceptance and usefulness, since several studies [19, 20] suggest that parents' satisfaction and motivation are important factors in measuring the AR process success or effectiveness. Results are analyzed in general terms, answering the research question and testing the formulated hypothesis.

The questionnaire statements and the descriptive statistics for each statement are presented in Table 4. To measure the internal consistency of statements Cronbach alpha coefficient was calculated, yielding a value of .95, indicating that the instrument has high internal consistency. To consider the internal statements reliability concerning the same construct as satisfactory, Cronbach alpha should be greater than 0.7 [21]. Construct validity was obtained from content validity.

Table 4 shows the mean (M) and the standard deviation (SD) of the score given by parents whose children had belonged to the experimental group who worked with AR, or control group, who worked without AR, in each one of the questionnaire dimensions. An improvement in the final score can be observed when AR is applied to learning. According to the results shown in Table 4, parents whose children worked with AR are more satisfied with their children achievements than those who have not used the AR system. A deeper analysis shows an interesting find. The standard deviation of the scores in the AR group is smaller than the one in the control group. This fact indicates that the score is less dispersed in the AR group. Thus demonstrating a more homogeneous improvement in parents' satisfaction is obtained when all the pedagogical aspects are combined in an AR tool, adapted to different preferences and profiles.

Table 4. Comparison of experimental and control group using Mann-Whitney U test.

	Experimental group parents		**Control group parents**		***p***
	Mean	Standard deviation	Mean	Standard deviation	*p*
Global	3.87	.05	2.77	.18	< .001
Motivation	3.79	.23	2.66	.29	< .001
Knowledge	3.86	.18	2.64	.30	< .001
Reading and writing	3.94	.12	2.82	.29	< .001
Creativity	3.87	.16	2.75	.38	< .001
Degree of satisfaction	3.91	.14	2.96	.50	< .001

To perform inference calculations, nonparametric statistics have been used. Table 4 presents results for the Mann-Whitney U test, where there is a level of statistical significance less than .05 in all evaluated dimensions, which leads us to conclude that there are significant differences among parents whose children work with AR, and those who do not work with AR. After resorting to subsequent post hoc tests, we conclude that there are significant differences between the experimental parent group and the control group ($p < .001$), in favor of the experimental group. Therefore, parents whose children have worked with AR are more satisfied with the results achieved by their children that those parents whose children have not worked with AR, although both groups have used the same educational system.

In general terms, the questionnaire data shows the experience was evaluated positively by parents. They liked learning through this system and positively assessed the integration of AR to the learning in preschool education. Besides, parents think that using AR didactical resources helped their children to promote motivation, knowledge, reading and writing, creativity and degree of satisfaction. Similarly, the parents were very satisfied with the use of AR as a didactical resource. They felt that the resources has important advantages since it integrates knowledge, reading and writing into a common framework that supports all the different activities of the learning process.

To finish, regarding gender, ages, level of education and current occupation differences, results show no differences between satisfaction levels of both groups.

5. Conclusions

This paper reports on a study about AR technology effects over parents when their preschoolers use Augmented Reality as a tool to learn. Firstly, parents like the AR technology since they regard it as useful, facilitating the learning process and promoting motivation, knowledge, reading and writing, creativity and degree of satisfaction. Similarly, families think that there are a lot of benefits in using a technological tool based on AR: the integration of several components in order to achieve a common goal, the possibility of managing the execution of the exercises in several contexts, or the availability of the system, among others. Therefore, the AR resources could be suitable for variety learning levels and not just in training for high-level levels, as typically occurs with new technological resources.

Another find, according to parents, is that AR didactical resources allows to work children with different levels of difficulty which has shown to be useful in increasing comprehension, as shown in the survey results and academic outcomes, gathered in another investigation performed by us pending of being published.

Since school tasks that prove too difficult, or too easy, could decrease students' motivation, adaptive problem sequencing would provide a more efficient and effective learning [22].

Moreover, this study results indicate that using AR technology has important positive effects on the students' academic outcomes, according to the parents. The families believe that the students who used the AR technology improve their reading and writing skills, so important in preschool education, therefore children could obtain better final grades.

Finally it should be indicated that results obtained in this study can be used as a basis for further investigation about the impact of using AR technology in programming learning on preschool students. Finally, a qualitative research that includes observation through time could achieve alternative interpretations of the data and, thus, a richer discussion.

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