# Evaluating the Usage of Augmented Reality in General Education Schools of Saudi Arabia

**Haneen Hassan Al-Ahmadi**
Software Engineering Department,
College of Computer Science and Engineering
University of Jeddah, Saudi Arabia
E-mail: hhalahamade@uj.edu.sa

**Abstract**

Over the last decade the swift evolution of technology has introduced new ways to develop applications and learning environment. It has been argued that, using technology in education can broaden the horizon of students and help them thinking interactively. This paper aims to evaluate the usage of augmented reality in education, especially in general education schools of Saudi Arabia. In this study, some factors have been considered such as, students' type (i.e., primary, intermediate and secondary), the main courses that apply the AR technology, the possible effect of using it in SA education, and challenges of using AR in educational settings. The most reported motive of using AR in Saudi Arabia schools is improving the quality of education skills. Some noted challenges imposed by AR are usability issues and lack of technical support. Other several challenges and effects of AR usage are founded, which will be discussed in detail.

**Keywords:** Augmented reality, learning environment, Saudi Arabia, general education school.

### Introduction

In recent years, many new technologies and resources have been increasingly presented in the teaching process. One of the most significant technologies that create a unique educational environment is generally referred as augmented reality. Augmented reality generally abbreviated as AR is an innovation in the modern world which was developed in order to convert the virtual stuff into the reality i.e. the real physical world, therefore, AR can be called as the perspective of reality (Kamphuis, 2014). As it can be agreed upon that a number of things are not practicably important, which means that training can be delayed and is not possible in a continuous manner in daily life due to a number of reason but cost and safety are at the top of the list. Therefore, in order to minimize the delays and the maximization of the excellence and innovation alternative methods and ways should be adopted. Augmented Reality has the potential to improve traditional teaching methods and introduce new and additional ways, which may make it easier for students to learn better and change the way that teachers share information and knowledge (Martins et al., 2015).

It is expected that the augmented reality (AR) would support the delay free learning, a positive learning environment and the complex learning as well (Kamphuis, 2014). This is difficult by a human being. Since AR is an emerging technology, it is a worthy opportunity to evaluate the usage of it in general education schools of Saudi Arabia. In this paper, we will discuss several factors such as the extent of using AR in general education schools of SA, the possible effect and challenges of applying it in educational environment. The structure of this paper will be as following: firstly, Literature Review of AR will be presented. Then a brief description of the Methodology that we have

used in this study will be illustrated. After that, Result and Discussion section will be elaborated. Finally, Conclusion and future work will be demonstrated.

### Literature review

Most studies stated that Augmented Reality is extremely useful in educational environment as it helps the educators to understand concept better and improve their skills and know-ledge. Moreover, as concluded by the educationalist, the traditional way of maintaining a fake class room environment for the students which does not run parallel to the augmented reality phenome-non. The traditional classroom structure and method was not supported by the critics.

Several studies discussed the evolution and concept of AR technology which is expected to take over the human in future decades. Pasarét et al. (2011) stated "the revolution in the Augmented reality was initiated in the year 1968. It was initiated by Ivan Sutherland when he displayed the first headed 3D graphic which was 2D model. In the later years the AR was designed for and used by the pilots and crews in order to execute the plans that needed very precise information and error free acts, the AR was used in order to get through the basic flight information for the pilots. Then the version was updated and it was evolved to helmet mounted display".

According to Zhu et al. (2014) "the augmented reality is also called as "mixed reality" is a technology which is capable of transferring the real life models to the real world, which may be di-rect or indirect. Moreover, the real world is presented in the virtual manner." It is unlike virtual real-ity that totally plunges the user in computer-generated virtual settings.

Moreover, Chiang (2014) defines AR technology as an innovation that enables the combina-tion of the real life sensory to produce the same real life sensory virtually. In addition, Chiang (2014) reported that according to Azuma (2001), three features of AR includes; Virtual objects pre-sented in real life world, Relation between real and virtual world, Communication between real and virtual world.

According to Wu et al. (2013) studies can be easier and full of concepts by the demonstration of 3D objects. By the demonstration of the 3D objects the interaction of the students with their im-agination would be much easier than before.

In other words, students can inspect the 3D object from different perspectives to develop their understanding. Chen et al. (2017) reported that AR in educational settings give rise to better learning performance and promoting learning encouragement. Furthermore, he argued that deeper student engagement improved perceived enjoyment of learning.

#### *Augmented Reality Benefits*

As the technology progress in our daily life and how the young people are interested in it, the educational sector is seeking to take advantage from it. For instance, the AR is applied to the schools to improve the outcomes. These improvements will be achieved by gaining the student attention and using their full sense during the classes. Another advantage of using AR is that the efficiency of classes will be enhanced by increasing the interactive with AR technology. Moreover, it is an easy and it's an enjoyable technology which encourages the student to use it.

#### *Augmented Reality Challenges*

One of the main challenges is that AR has some of difficulties during the implementation. First, technical challenges for instance, the teachers lack of technical background to deal with the new technology. The second challenge is the lack of experience that the schools should provide a training to improve their faculty members. Furthermore, financial challenge which means that AR technology needs several equipment (such as: computer, camera etc.) and that will require a high

budget to acquire them. Also, the crowed classes are considered as one of the main challenges, that's because it is hard to control and supervise the students.

### The objectives of the study

Our study aims to clarify the effectiveness of using Augmented Reality technology in general education schools of Saudi Arabia. Furthermore, to demonstrate the obstacles encountered during the implementation of AR technology as well trying to provide several solutions that might help to overcome these challenges and increase its usage more widely in the future.

### Methodology

In order to evaluate the usage of augmented reality in general education schools of Saudi Arabia, an unstructured interview was conducted with few teachers in education field to get a clear idea about the supporting technology they usually use in the classrooms. In addition, an online survey was delivered to a small sample of 100 employees from different schools of Saudi Arabia. The survey date was from March 20, 2018, to April 10, 2018. This survey was distributed to both gender male and female of education staff members. The questionnaire covered different factors associated with using augmented reality in schools such as reasons for using this technology in classrooms, the impact of applying it in educational context, prediction about the impact of AR in the future of education and some challenges that have been faced when using it in the schools.
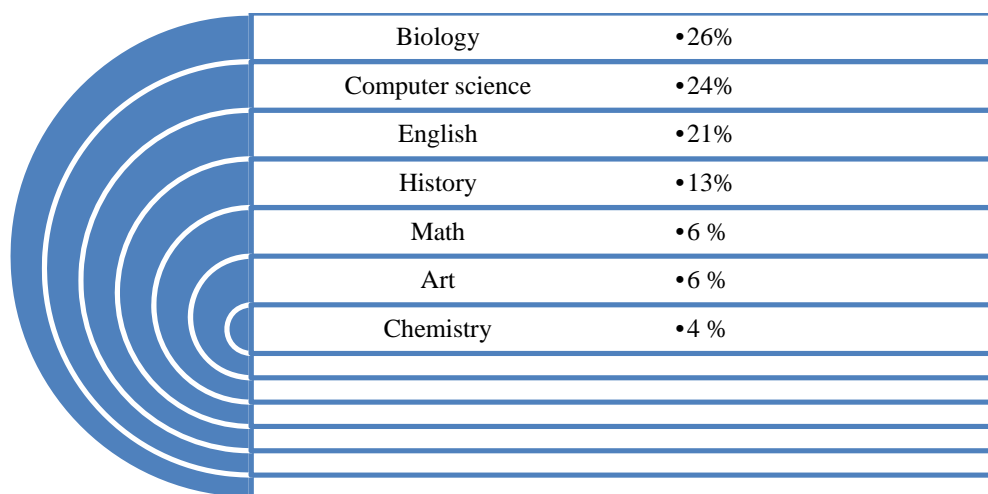
At the begging, the first question discussed in the survey addressed the extent of using AR in general education schools of SA, either it is used in the school or not. Secondly, three multiple choice questions are submitted to determine the type of students which are participating for using AR in the school (primary, intermediate and secondary), the main courses that use AR technology and how long they have used this technology in schools.

To measure the students' familiarity level of using any new technology in education one scaling question is presented. In addition, in order to assess the quality of implementing AR in Saudi Arabia educational setting, two multiple closed questions are included. One of these questions asked the respondents to complete the sentence which describe their expectations about utilizing AR in their schools and the other one determined wither AR improves the quality of acquiring the educational material or not?

Moreover, three questions are asked to demonstrate the reasons of using this technology in Saudi Arabia education environment, its impact, and challenges. After that, two questions are presented to evaluate the satisfaction level of using AR in SA schools and how satisfied are respondents with technical support. Another substantive question was asked to find out the subjects' prediction about AR in the future. The survey was closed to further responses in April 10, 2018, and the data was subsequently downloaded for analysis.
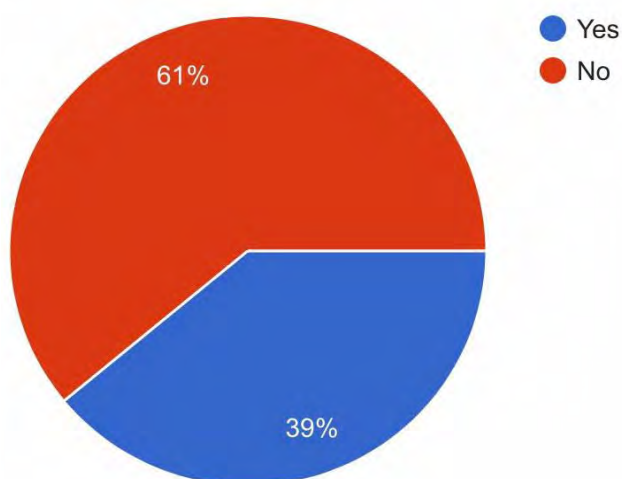
### Results and discussion

Recent literature highlights different studies on augmented reality and points out its positive effects on students' motivation and engagement (Kamarainen, 2013). The results of our research support this characterization, as the teachers reported high levels of student engagement with the technology in different courses such as science especially in biology subject about 26% followed by computer science subject around 24% and English subject about 21%. In addition, there are some other subjects that were discovered through our survey that use this technology including Math, History, Art and Chemistry (See figure 1).

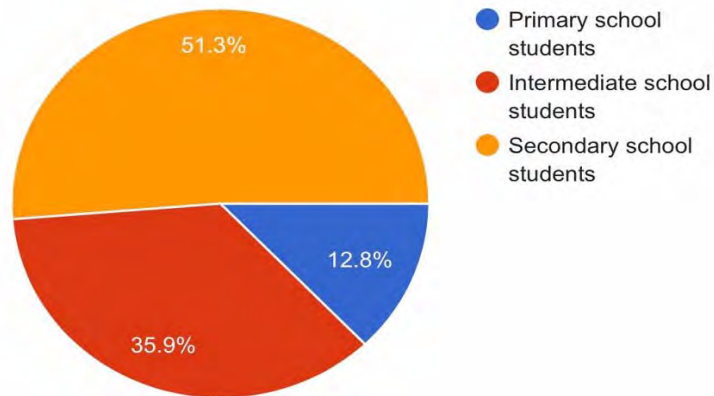| Biology | •26% |
| Computer science | •24% |
| English | •21% |
| History | •13% |
| Math | •6 % |
| Art | •6 % |
| Chemistry | •4 % |

**Figure 1. Use this technology in different courses**

The survey has demonstrated the extent of using Augmented Reality (AR) in general education schools of Saudi Arabia where around 39% of SA schools are using Augmented Reality (AR) technology in their classrooms where the highest percentage of applying it was in secondary schools (See figure 2 and 3).
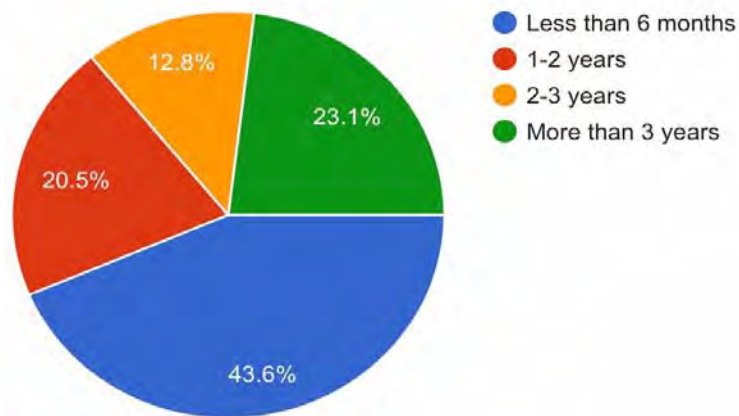
This technology has been used for three years and more in various schools and recently, in the last six months its usage has been increased dramatically. The percentage was jumped from 23% to 43.6% (See figure 4). This leads to improving the quality of acquiring educational material. The fact was confirmed by different respondents as 69% of them agree with this statement and illustrate that the most motives for applying it in general education schools is to establish intelligent educational environment.



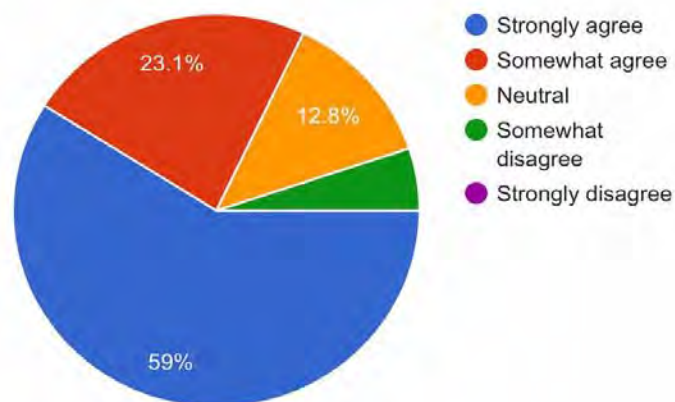**Figure 2. AR technology in Schools**

**Figure 3. AR technology at different level of schools**



**Figure 4. Trends of using AR technologies in Schools**

The impact that technology has had on today's schools has been quite significant. About 82% of teachers emphasize that a large number of students are very interesting in new technology (See figure 5). The widespread adoption of technology has completely changed how teachers teach and students learn. It is clear that students prefer technology because it breaks the routine and makes learning more interesting



**Figure 5. Interest in new technology**

It is clear that from the survey around 64% of participants reported that implementing an Augmented Reality in their schools was better than expected and 14% of them are generally satisfying about the using of it in the classroom (See figure 6 and 7).
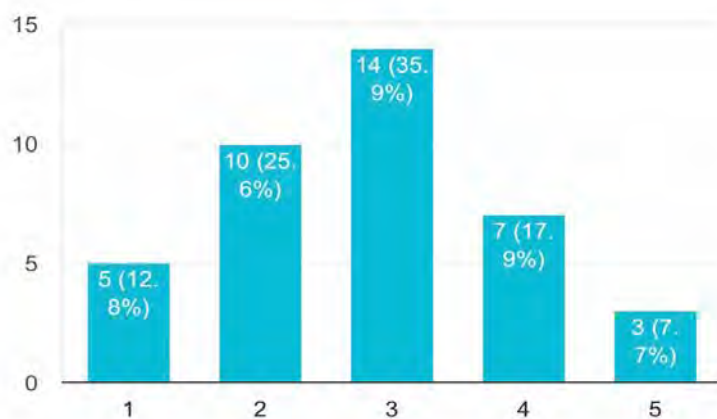


**Figure 6. Expectations of teachers regarding new technology**
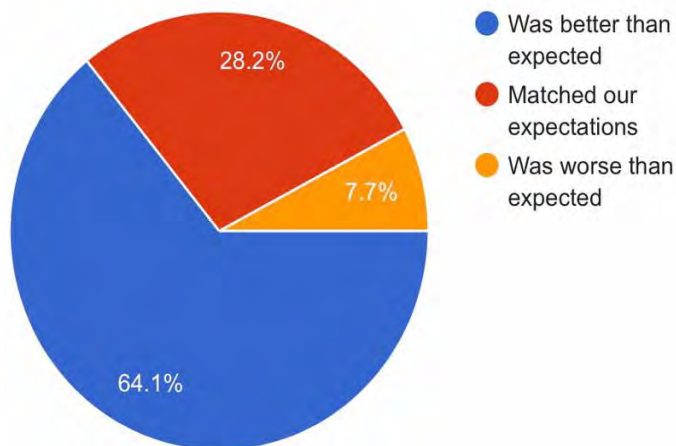


**Figure 7. Expectations of teachers**

According to (Gajic, 2015) technical support personnel are able to tackle specific problems (products, application, etc.) and build sustaining relationship with customer. This was addressed in our survey as more than 50% of respondents are satisfying about AR technical support (See figure 8).

### *Reasons of limited extent of using AR in SA schools (Ishikawa Diagram)*

After analyzing the result of the survey, Ishikawa Diagram, which is also called fishbone diagram, was used to illustrate the factors causing limited use of AR technology in Saudi Arabia schools (See figure 9).
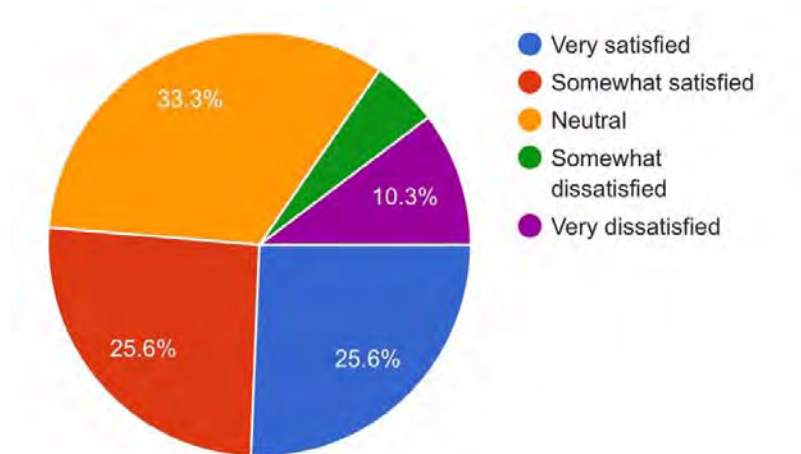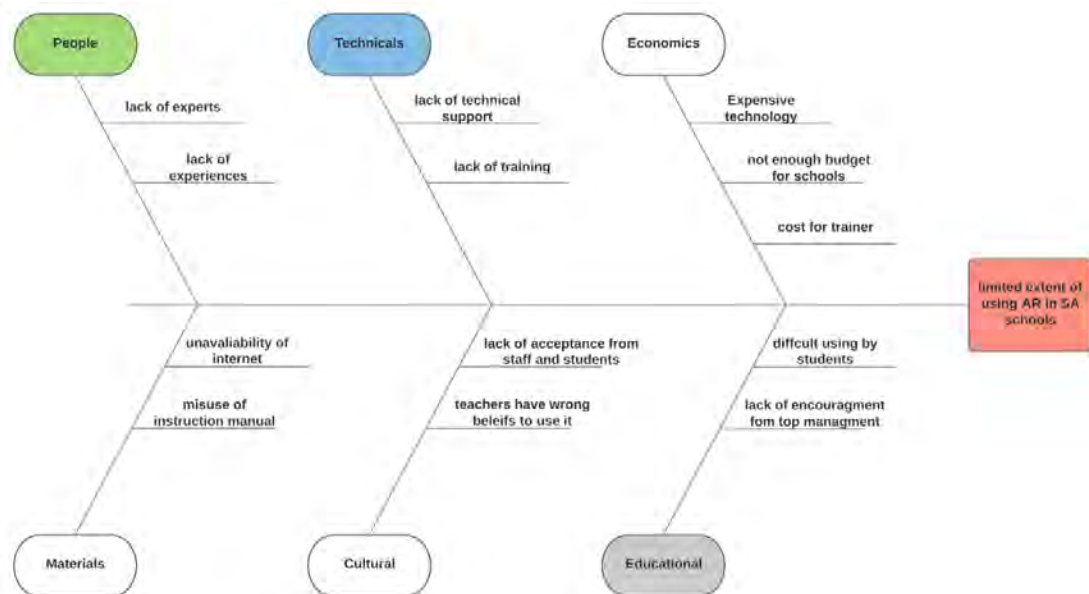
**Figure 8. Level of satisfaction with AR technology**
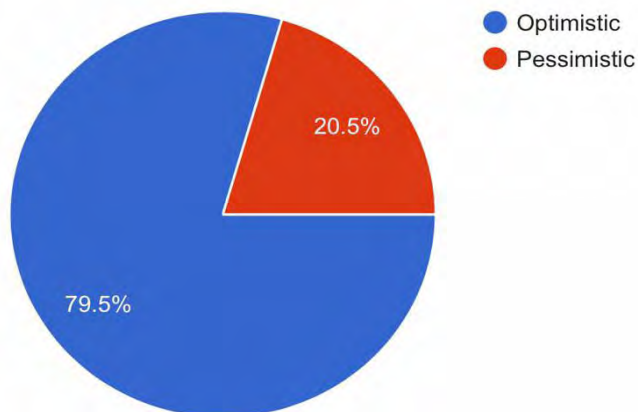


**Figure 9. Ishikawa Diagram**

### Innovative Characteristics

According to our survey we can illustrate that the most important reasons of using AR in the public school is to establish intelligent educational environment. For instance, providing a visualize objects (images of courses concepts) and allowing the students to interact with it. As a result, this environment will increase the students understanding.

### Impact in Saudi Arabia Education

Augmented Reality technology has many positive effects on enhancing the education method. After analyzing the survey results, we found that the student performance is increased. That's because they were concentrating and interesting about this technology. Also, the changing in the education method has a positive impact on the student's attendance. One of the main advantages of AR is that it allows us to integrate the virtual and the reality easily. According to that, the education sector especially schools taking benefits from it in simplifying and illustrating the courses. Moreover, the quality of the courses will be improved which leads to curriculum development. To sum up,

it is clear that AR has a positive effect on the learning outcomes and most of the respondents around 79.5% are optimistic about the future of AR in educational environment (See figure.10).



**Figure 10. Response about the future of AR technology**

### *Overcoming the Limited Usage of an Augmented Reality in Saudi Arabia's Schools*
**-** *Achieving the vision 2030*

As the technology will be a key enabler and driver of the numerous changes envisioned by vision 2030 with the goal of developing the nation's digital infrastructure, it is the time for general education schools to use the modern technology to improve the quality of education. Augmented Reality technology is considered one of the most significant ones that has great potential of added benefits for students.

**-** *Increasing the awareness of needs for AR*

A great effort is needed to raise the teachers' awareness of using Augmented Reality in educational environment and emphasize that it is highly likely that AR can make learning settings more productive and interactive than ever before.

**-** *Training*

In the implementation of any new technology there may be a lack of knowledge on how to use and deal with it, the Ministry of Education must provide professional trainers for teachers to use the Augmented Reality technology in a successful manner, provide technical support and maintenance continuously to motivate all schools in Saudi Arabia to use it smoothly without any defects.

- *Economics*

In the implementation of any project, especially technical projects require a high budget to include all the needs such as (tools, trainers, maintenance, etc) and always there is sponsor for them. When implementing the Augmented Reality in schools, it defiantly requires a special budget. Therefore, the Ministry of Education and school principals must provide adequate budget to implement this technology and ensure that the funds are properly invested and disbursed to serve the students and the teachers instead of spending them in the school decor or secondary things. So, good school administration is very important and contributes to create an innovative and productive generation.

### Conclusion

In conclusion, it is widely accepted that Augmented Reality is a recent trend in IT technology that used in education environment, which boost engagement and help students to develop their understanding deeply. This study was established in order to evaluate its usage in Saudi Arabian

general education schools that might help better development and adoption of this technology for teachers and learners. The significance of this study is that it was done in the general education schools of Saudi Arabian, which is unique and novel in approach for the country.

Based on the result of our survey we found that around 39% of Saudi Arabia schools are using this technology in classrooms where the highest percentage of applying it was in secondary schools. We analyzed the reasons of limited extent of the usage of AR technology in Saudi Arabian schools by using fishbone diagram and provided different suggestions to overcome this issue. Moreover, it is clear that from the survey result the respondents' feelings and prediction about utilizing AR in the learning environment was optimistic. Our future work, may present how AR technology works, showing some examples of popular products and applications that are used in general education schools.

### References

Chen, P., Liu, X., Cheng, W., & Huang, R. (2017). A review of using Augmented Reality in Education from 2011 to 2016. In *Innovations in Smart Learning* (pp. 13-18). Springer, Singapore.

Chiang, T. H., Yang, S. J., & Hwang, G. J. (2014). An augmented reality-based mobile learning system to improve students' learning achievements and motivations in natural science inquiry activities. *Journal of Educational Technology & Society*, *17*(4), 352.

Cox, J. (n.d.). Benefits of Technology in the Classroom. Retrieved March 15, 2018, from http://www.teachhub.com/benefits-technology-classroom

Gajic, N., & Boolaky, M. (2015). Impact of Technical Support on Customer Satisfaction: Case of Automotive Paints. *SAGE Open*, *5*(4), 2158244015611457.

Giasiranis, S., & Sofos, L. (2017). Flow Experience and Educational Effectiveness of Teaching Informatics using AR. Journal of Educational Technology & Society, 20(4), 78-88.

Gün, E. T., & Atasoy, B. (2017). The Effects of Augmented Reality on Elementary School Students' Spatial Ability and Academic Achievement. Egitim ve Bilim, 42(191).

Ibáñez, M. B., Di Serio, Á., Villarán, D., & Kloos, C. D. (2014). Experimenting with electromagnetism using augmented reality: Impact on flow student experience and educational effectiveness. Computers & Education, 71, 1-13.

Kamarainen, A. M., Metcalf, S., Grotzer, T., Browne, A., Mazzuca, D., Tutwiler, M. S., & Dede, C. (2013). EcoMOBILE: Integrating augmented reality and probeware with environmental education field trips. *Computers & Education*, *68*, 545-556.

Kamphuis, C., Barsom, E., Schijven, M., & Christoph, N. *(2014). Augmented reality in medical education?. Perspectives on medical education, 3(4), 300-311.*

Karagozlu, D. Determination of the impact of augmented reality application on the success and problem-solving skills of students. Quality & Quantity, 1-10

Martins, V. F., Gomes, L., & de Paiva Guimarães, M. (2015, June). Challenges and Possibilities of Use of Augmented Reality in Education. In *International Conference on Computational Science and Its Applications* (pp. 223-233). Springer, Cham.

Pasaréti, O., Hajdin, H., Matusaka, T., Jambori, A., Molnar, I., & Tucsányi-Szabó, M. (2011). Augmented Reality in education. *INFODIDACT 2011 Informatika Szakmódszertani Konferencia*.

Wu, H. K., Lee, S. W. Y., Chang, H. Y., & Liang, J. C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & education*, *62*, 41-49.

Yilmaz, R. M., & Goktas, Y. (2017). Using augmented reality technology in storytelling activities: examining elementary students' narrative skill and creativity. Virtual Reality, 21(2), 75-89.

Zhu, E., Hadadgar, A., Masiello, I., & Zary, N. (2014). Augmented reality in healthcare education: an integrative review. *PeerJ*, *2*, e469.