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A Content Analysis on Articles Using Augmented Reality Technology and Infographic in Education

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Abstract: The rapid development of technology and the changes it creates affect not only human life, but also education. Two of the most handled items of technological advances in education today are Augmented Reality and infographic usage. These two elements are actively used in learning environments today and the importance of these two elements is increasing in academic studies. The general purpose of this research is to perform content analysis of the articles using augmented reality technology and infographic in education. The sample of the research is composed of published articles on Augmented Reality technology and infographic. The sample of the research consists of articles published on Augmented Reality technology and infographic in the field of Education published on Google Scholar between 2016-2020. The articles related to the research were examined on the basis of content analysis. The data obtained were analyzed using descriptive statistical methods, namely percentage and frequency. It is thought that the results obtained at the end of the study will shed light on future studies.

Keywords: *Augmented Reality; Infographic; Education; Teaching.*

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1. Introduction

The changes in technology are increasing and the innovations that these changes have brought about in education are growing day by day. With the advancing technology in recent years, "augmented reality", that is, the usage areas of augmented reality technologies in education, has increased gradually (Erbaş & Demirer, 2014). Augmented reality is the environment offered to individuals by creating sensory spaces in the same proportion between the universe we are in and the virtual world. (Özarslan, 2011). To make it broader, Augmented reality is a technology that enables the interaction of real and digital objects simultaneously by adding a digital layer to objects created by a camera. If it is explained in a shorter way, it enables the interaction of real and digital elements at the same time. (Abdüselam & Karal, 2012). The fact that augmented reality technology appeals to multiple senses and can offer real learning experiences enables a more enriched use of educational environments. (Ke ve Hsu, 2015). This enriched learning environment enables learners to learn by gaining experience with applications in virtual environments on the real world. (Johnson et al., 2011). Along with augmented reality technology, students also have the opportunity to communicate face-to-face and share their interests, knowledge, knowledge and experience. (Lave & Wenger, 1991). It is observed that the studies and researches carried out abroad and domestically regarding the use of augmented reality applications in education are increasing day by day. In studies where a learning environment using augmented reality-based applications is compared with a classical learning environment, it is observed that learning using augmented reality technology is more efficient. (Kaya & Bicen, 2019). Augmented reality facilitates learning by providing a detailed view of inaccessible objects, other systems or objects making learning difficult in the learning environment (Hsiao & Rashvand, 2011). With the prominence of the senses in education, the usability of the Augmented reality in the field of education is increasing day by day and it is seen that more recent applications have been developed in the recent years. (Kesim & Özarslan, 2012). With the widening of the information fields in the learning environment, individuals started to be exposed to desired or undesired visual stimuli. Visuality has a very important place in education. Apart from the augmented reality technology, infographics also serves visualization, which is one of the most important learning strategies in education, and infographics are one of the most effective methods of information visualization (Nuhoglu Kibar & Akkoyunlu, 2015). Infographics is defined as an info graphic with

the combination of words in the information and graphics. It is the presentation of a combination of text and visuals, rather than just transferring information in a written form. (Borucu, 2015).

Infographics take an important place in the transfer of information to the student. When the literature is examined, it has been shown that the use of infographics in the course creates positive effects in the educational environment (Vanichvasin, 2013). Using infographic is thought to be a powerful tool for persuading, directing and mobilizing individuals, as well as making information permanent and more understandable (Uyan Dur, 2014). In the process of preparing the infographics, it enables the learners to use new information as well as obtaining new information and organizing and presenting the information (Baglama et al., 2017). Accordingly, when the literature is examined, studies aiming to integrate the infographic into education are increasing day by day. The key point in using the infographic design as a basic teaching tool in the learning and teaching process is to provide students with the awareness of self-learning by ensuring that the designs are developed by the students themselves (Kibar, 2016). Based on these findings, it is observed that the use of augmented reality and infographic in the education and training process has contributed significantly to student success and learning in the learning process and the studies aiming to integrate these two areas into the educational environment have increased day by day. In this study, it is aimed to analyze the studies using augmented reality technologies and infographic designs in terms of various variables and to shed light on the future studies and researchers.

1.1. The aim of the study

The aim of this study is to analyze the articles containing Augmented reality technology and the use of infographic in education. The sub-objectives determined to achieve the general aim are as follows:

1. How is the distribution of studies using augmented reality technology according to the publication years?
2. How is the distribution of articles using augmented reality technology according to the number of authors?
3. What are the research methods used in articles containing Augmented Reality Technology?
4. What are the disciplines where articles about Augmented Reality Technology are used?
5. How is the distribution of the articles examined on the use of infographic in education by year of publication?

6. How is the distribution of articles related to the use of infographic in education by the number of authors?

7. What are the research methods used in articles related to the use of infographic in education?

8. What are the Disciplines where articles about the use of infographic in education are used?

2. Method

This research, which examines articles about Augmented Reality and the use of infographic in education, is based on content analysis. Content Analysis is a research technique that aims to make repeatable and valid inferences from text and documents about the concepts used (Krippendorff, 2012). In another definition, it is defined as a systematic review of the prominent content of communication in neutral and quantitative ways (Berelson, 1952).

Sample

The sample of the research is composed of published articles on Augmented Reality technology and infographics. The sample of the research consists of articles published on Augmented Reality technology and infographics in the field of Education published on Google Scholar between 2016-2020. As a result of the research, the articles were examined and the studies were supported in the light of the information provided.

Data Analysis

The data obtained within the scope of the study were analyzed using descriptive statistical methods, in other words percentage and frequency. The percentages of the data depending on the frequencies were calculated to meet the answer of each research question and presented in tables.

Scanning Criteria

In order to determine the projects to be used in the study, some screening and selection criteria were determined by the researchers. After the criteria were determined, it was searched on the basis of the keywords "Augmented Reality", "Infographic", "Infographic in Education" in the database of "Google Scholar", which includes teaching themed projects published between 2006-2018. Based on these selection criteria, articles outside the field of Education are excluded from the scope of the study.

37 articles related to Augmented reality technology and 13 articles related to Infographic Use in Education were evaluated suitable for the

criteria determined at the end of the screening. The studies were examined in terms of “publication years, research topics, methods, researchers, quantities and the disciplines used”.

3. Findings and Comments

3.1. *Distribution of Projects by Publishing Years*

Table 1. Distribution of Projects on Augmented Reality Technology according to their Publishing Years

Publishing Years of Studies	Number of Articles	%
2016	9	%24,4
2017	10	%27
2018	10	%27
2019	8	%21.6
2020	0	%0
Total	37	%100

Source: Authors own conception

When the distribution of studies on the use of augmented reality technology in education is analyzed by years, the highest number of studies is observed between 2017-2018 with 27%. These studies are followed by the studies conducted in 2016 with 24.4%. The least published articles are in 2019 with 21.6%. In 2020, there is currently no index study.

3.2. *How is the distribution of articles using Augmented reality technology according to the number of authors?*

Table 2. The Distribution of Articles Using Augmented Reality Technology According to the Number of Authors

Number of Authors	%
1	%24,3
2	%48,6
3	%19
4	%2,7
5	%5,4
Total	%100

Source: Authors own conception

When looking at the number of authors in augmented reality studies, the percentage of articles with two authors is highest with 48.6%. Articles with two authors are followed by articles with a single author with 24.3%. The third highest percentage is articles with three authors, with 19%. Among the studies, the highest number of authors was found to be five, and it is seen that

it has the fourth highest percentage with 5.4%. Among the articles reviewed, the articles with the lowest percentage are articles with 2.7% with 4 authors.

3.3. What are the research methods used in articles containing Augmented Reality Technology?

Table 3. The research methods used in articles containing Augmented Reality Technology

Type of research	Number of Articles	%
Quantitative	15	%40,5
Qualitative	13	%35.1
Mixed	9	%24,4
Total	37	%100

Source: Authors own conception

In the percentage of the methods used by the studies that include the use of Augmented reality technologies in the field of education between 2016-2020, the highest rate is in studies using quantitative methods with 40.5%. The second highest rate was qualitative methods with 35.1%. The lowest rate was the studies using mixed research methods, with 24.4%.

3.4. What are the disciplines where articles about Augmented Reality Technology are used?

Table 4. The distribution of the disciplines where articles about Augmented Reality Technology are used

Research Topics	Number of Articles	%
Information technologies	4	%10,8
Science	8	%21,6
Pre-school	1	%2,7
Educational Sciences	10	%27
Maths	8	%2,7
Turkish	1	%21,6
Art	1	%2,7
Music	1	%2,7
History	1	%2,7
Foreign language	2	%5,5
Total	37	%100

Source: Authors own conception

As for the augmented reality technology, the disciplines included in the related articles are given in Table 4 and the studies include 10 different

disciplines. Studies in these disciplines are mostly found in the field of postgraduate Educational Sciences. Science and Mathematics follow educational sciences with 21.6%. In disciplines containing information technology about augmented reality technology, only 4 articles were found with 10.8%. Information technologies is followed by Foreign Language containing 2 articles with 5.5%. Only 1 article was found including Turkish, Painting, History, Music, Preschool education.

3.5. How is the distribution of the articles examined on the use of infographic in education by year of publication?

Table 5. The distribution of the articles examined on the use of infographic in education by year of publication

Number of Authors	%
1	%23,1
2	%46,1
3	%7,7
4	%23,1
5	%0
Total	%100

Source: Authors own conception

Considering the number of authors in the articles examined about the use of infographic in education, the articles with two authors with the highest percentage are 46.1%. The articles with two authors are followed by studies with one author and four authors with 23.1%. The third highest percentage is articles with three authors with 7.7%. No articles were found in the index with the number of five authors in the articles that use infographic in education.

3.6. How is the distribution of articles related to the use of infographic in education by the number of authors?

Table 6. The distribution of articles related to the use of infographic in education by the number of authors

Publishing Years of Studies	Number of Articles	%
2016	4	%30,7
2017	4	%30,7
2018	5	%38,4
2019	1	%7,7
2020	0	%0
Total	37	%100

Source: Authors own conception

When the distribution of studies on the use of infographics in education is analyzed by years, it is seen that the highest number of studies was conducted in 2018 with 38.4%. These studies are followed by studies conducted in 2016-2017 with 30.7%. The least published articles appear to be in 2019 with 7.7%. In 2020, there are no studies that fall into the index, such as articles using augmented reality technologies in education.

3.7. What are the research methods used in articles related to the use of infographic in education?

Table 7. Distribution of Articles on the Use of Infographic in Education by the Types of Research Applied

Types of research	Number of articles	%
Quantitative	3	%23,1
Qualitative	5	%38.4
Mixed	5	%38,4
Total	13	%100

Source: Authors own conception

When we look at the percentage of the methods used in the studies on the use of infographic in education between 2016 and 2020, it is seen that the articles using the Quantitative methods are 23.1%, while the Qualitative and Mixed methods are 38.4%. It is seen that articles on the use of Infographic in education tend to use mixed and qualitative methods more when compared to articles using Augmented reality technology.

3.8. What are the Disciplines where articles about the use of infographic in education are used?

Table 8. Distribution of Articles on the Use of Infographic in Education According to the Disciplines Used

Research Topics	Number of Projects	%
Information Technologies	3	%23,1
Science	1	%7,7
Social Sciences	1	%7,7
Educational Sciences	3	%23,1
Maths	3	%23,1
Geography	2	%15,3
Total	13	%100

Source: Authors own conception

As a result of the examination, the use of Infographics in education is seen in a limited number of disciplines compared to the use of augmented reality technology. While 10 disciplines have been found in studies on augmented reality technology, it has been observed that the articles examined on the use of Infographic in Education are used intensively in six disciplines. In studies carried out within these disciplines, it has been observed that the highest rate is 23.1%, in the field of Information Technologies, Mathematics and Educational Sciences. These disciplines are followed by studies in geography with 15.3%. The studies with the minimum percentage of 7,7% are done in science and social studies disciplines.

4. Results and Discussion

Moving from the first sub-purpose of the study, when the distribution of studies using Augmented reality technology in education is analyzed by years, the highest rate of study was seen as 27% between 2017 and 2018. The content analysis made in 2018 by Bal came across in 2015. Based on this result, it can be said that studies using augmented reality in education have increased over the years.. When the distribution of studies on the use of infographics in education is analyzed by years, it is seen that the highest number of studies was conducted in 2018 with 38.4%. Uzunboylyu & Beheshti (2017) stated that the highest publishing rate was realized in 2012 in their content analysis on infographic. Based on this result, it was determined that the articles published on Infographics showed a significant increase. When the distribution of the number of authors is compared, the results obtained from the articles examining the use of augmented reality technology and infographic in education are similar, and the data obtained support this. Considering the number of authors in augmented reality studies, the articles with two authors with a maximum percentage of 48.6%. When the number of authors is examined in the articles examined about the use of infographic in education, the articles with two authors have the highest percentage as 46.1%, as in Augmented reality technology. Uzunboylyu & Beheshti (2017) stated that in their infographic studies in which the number of authors were examined, articles written with more than one author appeared more intensely than single authors supporting the data obtained in this study. Among the methods that include the use of Augmented Reality Technologies in the field of education, the highest percentage of the methods used by the studies is the studies using quantitative methods with the highest rate of 40.5%. In the articles related to the use of Infographic in education, it is seen that the Qualitative and Mixed

methods, which are contrary to this result, are used more than the quantitative methods with a ratio of 38.4%. Sünger (2019) made a content analysis of the theses on augmented reality in his master's thesis study titled "Content Analysis on Augmented Reality Concept". In his data, he stated that more practice-based methods are used in theses rather than qualitative quantitative and mixed methods. With this research, it can be said that the methods used in theses and articles will differ both in the disciplines and the methods used. When we look at the disciplines where augmented reality technology is used in education, studies include 10 different disciplines. Studies in these disciplines are mostly found in the field of postgraduate Educational Sciences. Educational sciences is followed by Science and Mathematics with 21.6%. In Altınpulluk's (2018) study of "Investigation of Augmented Reality Theses Using Bibliometric Analysis in Turkey", it is determined that augmented reality related theses in Turkey are mostly realized in the field of Engineering and Education and when the data are analyzed, it is stated that the theses in the field of Computer Engineering, Education and Information Technologies are more in the foreground. In the "Educational Use of Augmented Reality: A Content Analysis" study conducted by Tekdal & Saygıner in 2012, it is determined that the highest rates are used in augmented reality applications in the field of Physics and Engineering education. It is seen that the results obtained from the studies coincide with the data obtained in this research. In the articles examined about the use of Infographic in Education, it is seen that the highest rate was 23.1% in Information Technologies, Mathematics and Educational Sciences.

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