Trends in Research on the Use of Digital Games in Education

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Abstract

This research aimed to examine studies on the use of digital games in education using bibliometric analysis. It used a descriptive scanning model. Academic studies indexed in the Web of Science (WoS) database were reached in the data collection phase. The database was searched using the keyword "digital game". "Document title", "abstract", and "keyword" were chosen as the search criteria. 760 academic studies in the "Education/Educational Research" and "Education Scientific Disciplines" categories published between 2005 and 2021 were included in the research. The bibliometric analysis method was used in the data analysis. The research results showed that most of the studies were articles and published in 2017 and 2018, English and Portuguese were the most published languages, most of the authors were affiliated with or supported by the National Taiwan University of Science and Technology among all the institutions and Anadolu University among the Turkish universities, Taiwan and the USA were the countries with the most publications, the number of citations increased after 2008, and the most common keywords used in the studies were digital game-based learning, game-based learning, and digital games. The research presents an overview of many components in the use of digital games in education. It is believed that the findings of the research will serve as a reference for future studies.

Keywords: Education, Digital game, Bibliometric analysis, Web of science

E-International Journal of Educational Research

Vol: 13, No: 4, pp. 40-56

Research Article

Received: 2022-04-22
Accepted: 2022-06-14

Suggested Citation

Yeşiltaş, E. & Cevher, S. (2022). Trends in research on the use of digital games in education, *E-International Journal of Educational Research*, 13(4), 40-56. DOI: https://doi.org/10.19160/e-ijer.1107500

INTRODUCTION

The attitudes of today's children towards digital games are mostly the opposite of their attitudes towards school and education. The attitudes children develop towards digital games correspond exactly to the student profile that educators want to see in their learning-teaching processes: interested, competitive, collaborative, result-oriented, in active quest for knowledge and solutions (Prensky, 2003). In this regard, the integration of digital games into education and academic studies on this subject are of great importance.

In recent years, the use of digital games in educational environments has started to attract attention, and research on this subject has become widespread as well. This is because it is known that games provide motivation, and it is thought that attempts to combine learning content with motivation for games will bring effective learning (Becta, 2001; Prensky, 2001; Gros, 2007; Woo, 2014). The literature suggests that digital games provide students with the skills to make quick decisions (Prensky, 2001), collaborate (Gee, 2003; Gros, 2007), create strategies to overcome obstacles and solve problems (Presky, 2001; Cicchino, 2015), and think critically (Cicchino, 2015). With the support of advanced technology, games allow for implementing instructional strategies in learning, enable students to interact and collaborate with their peers, encourage motivation, competition, and fun, support students' acquisition of knowledge to achieve learning goals, and allow them to customize learning based on their own skill levels and learning styles (Gee, 2003; Hwang & Chen, 2022).

Academic studies on the use of digital games in educational environments started to increase in the mid-2000s in parallel with the development and advance of technology. This increase has led to a need for bibliometric studies that reveal the state of the research area in order to answer questions about the direction of research trends on the use of digital games in education and which points should be considered in the preparation of future studies.

The literature on the use of digital games contains various meta-analysis studies. Talan, Doğan, and Battı (2020) conducted a meta-analysis and meta-thematic study on the effectiveness of digital and non-digital educational games. To determine the overall effect size, they included in their study the effect size comparison of 154 studies dealing with the effect of both digital and non-digital games on academic achievement during the 2004-2019 period. In addition, they presented a general picture of the effectiveness of digital and non-digital educational games by analyzing the publications in terms of sample sizes, student levels of educational games, treatment durations of game activities, school topics in which games were used, class sizes, game types, and achievement tests used. Clark, Tanner Smith, and Killingsworth (2016) conducted a meta-analysis on digital games, design, and learning and covered 69 articles published in peer-reviewed journals between January 2000 and September 2012. They obtained a general result by analyzing the publications in terms of variables such as game duration, the effect of digital games on learning, the effect of game design, and visual and narrative game features. Ritzhaupt, Poling, Frey, and Johnson (2014) conducted a synthesis study on digital games in education and covered 73 digital game research articles published between 2000 and 2010. They examined variables such as grade level, research method, treatment intensity and duration, game platforms used, and the number of participants. The results showed a steady increase in the number of publications on digital game in education since 2004.

The literature review indicates that previous studies have been meta-analysis studies and have focused on specific variables (e.g.,motivation (Wouters, van Nimwegen, van Oostendorp & van der Spek, 2013), competition (Chen, Shih & Law, 2020)) or specific fields (e.g.,sciences (Tsai & Tsai, 2020), mathematics (Byun & Joung, 2018)). Meta-analysis studies typically focus on a limited and analyzable number of studies and discuss the effects of certain variables on a result of interest. Bibliometric studies, on the other hand, complement these views by enabling a holistic synthesis of research flows and describing the distribution of patterns of research articles on a particular topic over a specific period of time, thereby identifying trends for emerging and future research areas (Schöbel, Saqr & Janson, 2021). The purpose of bibliometrics is basically to evaluate the scientific literature in a particular field, thus providing a broad perspective for any discipline (Andres, 2009). Bibliometric studies use a quantitative approach to describe, evaluate, and monitor published research. These studies have the potential to provide a systematic, transparent, and repeatable analysis process, thereby improving the quality of

analyses. Bibliometric methods contribute to literature reviews by guiding the researcher to studies with the highest impact and mapping the research area without subjective bias (Zupic & Cater, 2015).

The literature review found no comprehensive studies providing a bibliometric analysis of studies on the use of digital games in education. These studies are needed because the development and increase of technologies for digital games and the day-to-day rise in interest in these studies will require interpreting the accumulated knowledge. In this respect, the aim of the present research is to determine the academic studies on the use of digital games in education and to evaluate them bibliometrically. This evaluation will reveal the state of this research area on national and international levels and thus prevent the duplication of studies. In this regard, this research aims to bibliometrically analyze the studies on the use of digital games in education published between 2005-2021 and indexed in the Web of Science (WoS) database. To this end, answers were sought to the following research questions:

- What is the numerical distribution of academic studies on the use of digital games in education by year?
- What is the distribution of academic studies on the use of digital games in education by language of publication?
- What is the distribution of academic studies on the use of digital games in education by type of publication?
- What is the distribution of academic studies on the use of digital games in education by author institution?
- What is the distribution of academic studies on the use of digital games in education by author institution in Turkey?
- What is the distribution of academic studies on the use of digital games in education by country of publication?
- Which countries have cooperated in academic studies on the use of digital games in education?
- What is the distribution of the citation numbers of academic studies on the use of digital games in education by year?
- What are the most frequently used keywords in academic studies on the use of digital games in education?
- What is the reference co-citation network distribution of academic studies on the use of digital games in education?
- Which academic studies on the use of digital games in education most cited?

METHOD

Research Design

This research has been carried out in descriptive scanning model. Screening study is expressed as a research model that aims to describe a past or ongoing situation as it exists. In this research approach, the situation, person, event or object that is subject to the research is examined without the aim of affecting them in their own conditions (Karasar, 2014). In study, a descriptive scanning model was used as it was aimed to reveal research trends in academic publications on the use of digital games in education.

Data Collection

The Web of Science (WoS) database was used in the data collection phase. WoS, a product of the "Thomson Reuters Institute for Scientific Information (ISI)", derived from the Science Citation Index created by Eugene Garfield in the 1960s (Chadegani et al., 2013, p. 19). According to the current information available on the WoS website, it contains over 37,000 journals and more than 171 million records, and it includes a wide range of data from different citation databases (SCI, SSCI, SCI-Expanded, AHCI, ESCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH) containing various information collected from journals, conferences, reports, books, and book series (Yeşiltaş & Evci, 2021). This research used the WoS database because of its rich content and datasets allowing bibliometric analysis. In the study process, the whole WoS database on the Web of Knowledge web page was searched using the keyword "digital game".

"Document title", "abstract", and "keyword" were chosen as the search criteria. To reach a holistic interpretation, the study was carried out starting from the oldest date available in the database, covering the 16-year time period between 2005-2021. The bibliometric data of 760 academic studies in the "Education/Educational Research" and "Education Scientific Disciplines" categories out of 1,708 results reached through the search were used as the dataset.

Data Analysis

Data were analyzed by the bibliometric analysis technique. While statistical bibliography was first used in 1922 by E. Wyndham Hulme from the University of Cambridge, bibliometric analysis was first used by Pritchard. Pritchard defined bibliometric analysis as the application of mathematics and statistical methods to books and other scientific communication tools (Pritchard, 1969).

In the present research, a total of 760 studies published on the use of digital games in education between 2005 and 2021 were examined and categorized based on bibliometric indicators. The percentages and frequencies of the categorized data were calculated. MS Excel was used for these calculations. The research topics and trends of the academic publications examined within the scope of the research were visually mapped through the keywords in the publications. For that, WordArt online word cloud software was used. The social network analysis of the keywords of 760 academic studies on the use of digital games in education was visualized through the VOSviewer (Version 1.6.16) package, which is a bibliometric analysis tool. VOSviewer is a tool for creating maps based on network data and exploring these maps by visualizing them. The functions of VOSviewer can be summarized as follows:

• Creating maps based on network data: It can be used to create networks of scientific publications, scientific journals, researchers, research institutions, countries, keywords, or terms. Items in these networks can be connected by co-authorship, co-occurrence, citation, bibliographic matching, or co-citation links.

• Visualizing and exploring maps: VOSviewer offers three different ways of visualizing a map: network visualization, overlay visualization, and density visualization (Van Eck & Waltman, 2013).

The said functions of the VOSviewer were employed in the present research.

FINDINGS

Publication Numbers by Year

The distribution of academic studies published on the use of digital games in education in WoS by year is given in Figure 1.

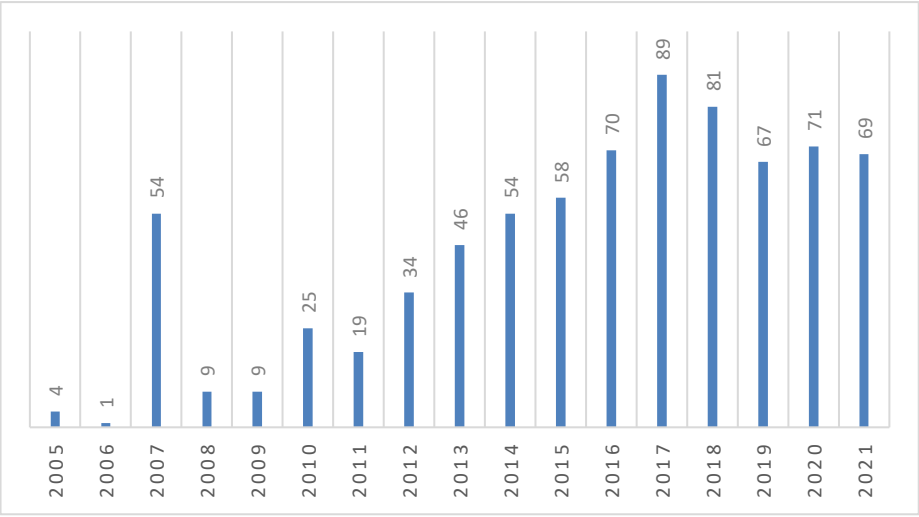

Figure 1. *Numerical distribution of studies on the use of digital games in education by year*

The data in Figure 1 indicate that most studies on the use of digital games in education were published in 2017 (f=89), 2018 (f=81), and 2020 (f=71). A holistic evaluation of the figure shows an

increase in the number of scientific publications on the use of digital games in education as of 2007. This may be about the worldwide spread of computer and internet use in the early 2000s.

Language of Publication

The distribution of academic studies published on the use of digital games in education in WoS by language of publication is given in Table 1.

Table 1. *Distribution of studies on the use of digital games in education by language of publication*

Languages	f	%
English	733	96.45
Portuguese	13	1.71
Spanish	6	0.79
Chinese	3	0.40
Italian	2	0.26
Norwegian	1	0.13
Russian	1	0.13
Turkish	1	0.13
Total	**760**	**100**

Table 1 shows that English (f=733) and Portuguese (f=13) are the leading languages in publications on the use of digital games in education. The reason why the number of publications in English, which is one of the most frequent languages of publication, is higher than in other languages may be the widespread use of English as the language of science and the language preferences of the journals indexed in the WoS database.

Type of Publication

The distribution of academic studies published on the use of digital games in education in WoS by type of publication is given in Table 2.

Table 2. *Numerical distribution of publications on the use of digital games in education by type of publication*

Type of Publication	f	%
Article	435	57.24
Proceedings Paper	297	39.08
Review	30	3.95
Book Chapter	24	3.16
Editorial material	21	2.76

Table 2 shows that most of the academic studies published on the use of digital games in education are articles (f=435), which are followed by proceedings papers (f=297) and reviews (f=30), respectively.

Institution of Author

Table 3 presents the distribution of the authors of scientific publications on the use of digital games in education in WoS by institution. Since the number of institutions in this category is very high (n=654), only the top 10 institutions in terms of the number of publications are included in the table.

Table 3. *Institutions of the authors publishing on the use of digital games in education - top 10 institutions*

Institution of Author	n	%
National Taiwan University of Science and Technology (Taiwan)	33	4.34
National Taiwan Normal University (Taiwan)	26	3.42
National Central University (Taiwan)	23	3.03
National University of Tainan (Taiwan)	19	2.50
Ghent University (Belgium)	14	1.84
National Cheng Kung University (Taiwan)	12	1.58
Interuniversity Microelectronics Centre (Belgium)	10	1.32
National and Kapodistrian University of Athens (Greece)	10	1.32
National Taipei University of Education (Taiwan)	10	1.32
Norwegian University of Science and Technology (Norway)	9	1.18

Table 3 shows that the leading institutions where the authors publishing on the use of digital games in education worked or which supported such authors are National Taiwan University of Science and Technology (f=33), National Taiwan Normal University (f=26), and National Central University (f=

23). It is a remarkable finding that most of the studies on the use of digital games in education were from Taiwan-based universities. Table 4 presents the Turkish Universities included in the list, their rankings, and their number of publications.

Table 4. *Institutions of the authors publishing on the use of digital games in education in Turkey - top 10 institutions*

Institution of Author	n	%
Anadolu University	3	0.42
Fırat University	2	0.28
Gazi University	2	0.28
İstanbul University	2	0.28
Uludağ University	2	0.28
Amasya University	1	0.14
Atatürk University	1	0.14
Bahçeşehir University	1	0.14
Balıkesir University	1	0.14
Dicle University	1	0.14

Table 4 shows that the leading Turkish institutions where the authors publishing on the use of digital games in education worked or which supported such authors are Anadolu University (n=3), Fırat University (n=2), Gazi University (n=2), İstanbul University (n=2), and Uludağ University (n=2).

Countries

The distribution of academic studies published on the use of digital games in education in WoS by country of publication is given in Table 5. Since the number of institutions in this category is very high (n=64), only the top 10 countries in terms of the number of publications are included in the table.

Table 5. *Countries where scientific publications on the use of digital games in education were published - top 10 countries*

Countries	n	%
Taiwan	162	21.32
USA	134	17.63
UK	41	5.40
People's Republic of China	40	5.26
Germany	39	5.13
Greece	33	4.34
Australia	28	3.68
Finland	28	3.68
Brazil	26	3.42
Canada	24	3.16

Table 5 shows that Taiwan (n=162), the USA (n=134), and the UK (n=41) are the leading countries of publications on the use of digital games in education in WoS.

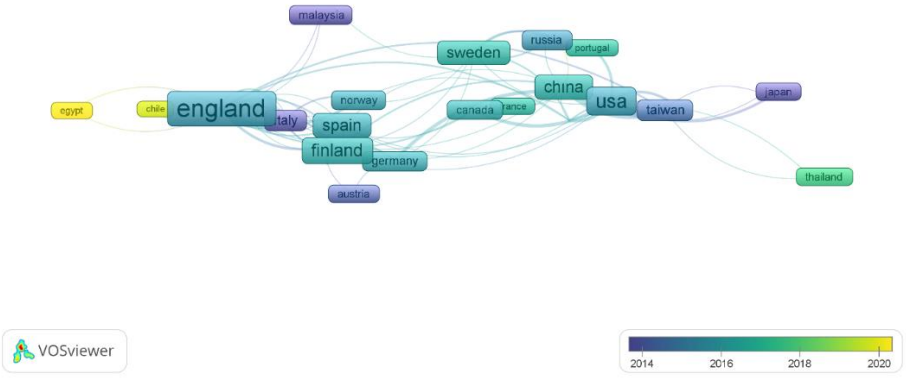

Figure 2. *Country collaborations based on the co-authorship analysis of scientific publications on the use of digital games in education (Frame size is about the number of publications, and yellow areas refer to their recentness)*

The cross-country collaboration based on the co-authorship analysis of publications on the use of digital games in education is shown in Figure 2. While the nodes in each analysis represent countries and institutions, the node sizes between them reflect the published articles, and the distance and thickness of the connecting links reflect the degree of collaboration. The countries in the graph are divided into 11 clusters, and there are 102 connecting links between them. UK has the biggest number of connections (20 connections). It is followed by the USA (13 connections), China (10 connections), and Spain (10 connections). These data show that the publications in the relevant countries involved cross-country collaboration.

Citation Analysis

The yearly distribution of the citation numbers of academic publications on the use of games in education in WoS is given in Figure 3.

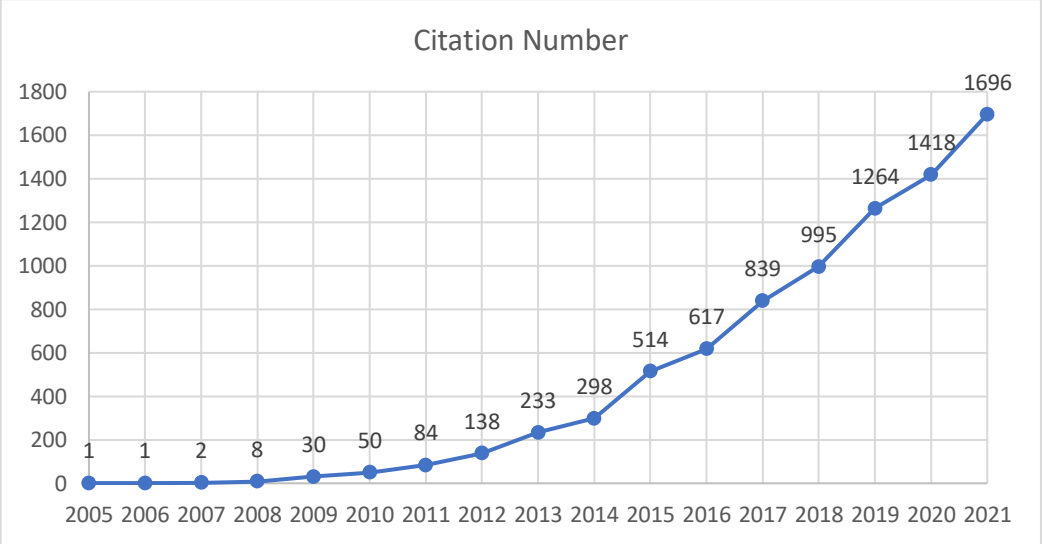

Figure 3. *The yearly distribution of the citation numbers of publications on the use of games in education*

Figure 3 shows that the citations of academic publications on the use of digital games in education were low from 2005 to 2008, but they went up with a rising rate of increase every passing year after 2008. This surge in the number of citations may be related to the increase in the number of scientific publications on this subject as a result of the widespread use and rising importance of games in education.

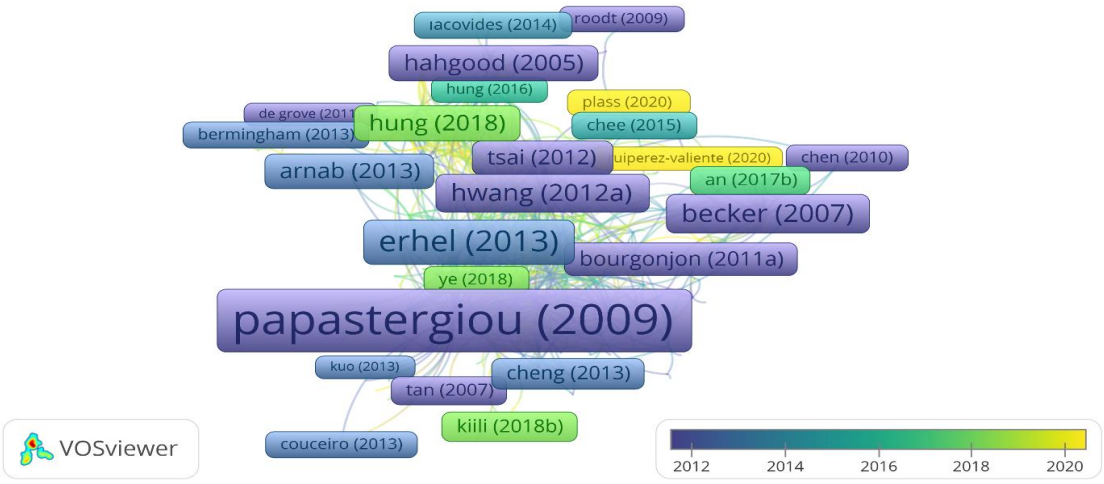

Figure 4. *The most cited academic publications on the use of digital games in education*

Based on the cluster analysis in the citation network graph, it is seen in Figure 4 that scientific publications on the use of digital games in education are grouped under 25 clusters. Among the publications in these clusters, the most frequently cited ones are Marina Papastergiou's article titled "Digital game-based learning in high school computer science education: impact on educational effectiveness and student motivation" (f=739), Severine Erhel and Eric Jamet's article titled "Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness" (f=233), and Gwo-Jen Hwang, Li-Hsueh Yang, and Sheng-Yuan Wang's article titled "A concept map-embedded educational computer game for improving students' learning performance in natural science courses" (f=217). Table 6 presents the data for the top 10 most cited publications out of 543 publications that could be included in the citation analysis as well as their connection strengths.

Table 6. *The most cited academic publications on the use of digital games in education - top 10 publications*

Publication Details	Citation Number	Connection Strength
Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & education*, *52*(1), 1-12. https://doi.org/10.1016/j.compedu.2008.06.004	739	67
Erhel, S., & Jamet, E. (2013). Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness. *Computers & education*, *67*, 156-167. https://doi.org/10.1016/j.compedu.2013.02.019	233	30
Hwang, G. J., Yang, L. H., & Wang, S. Y. (2013). A concept map-embedded educational computer game for improving students' learning performance in natural science courses. *Computers & Education*, *69*, 121-130. https://doi.org/10.1016/j.compedu.2013.07.008	217	21
Hwang, G. J., Wu, P. H., & Chen, C. C. (2012). An online game approach for improving students' learning performance in web-based problem-solving activities. *Computers & Education*, *59*(4), 1246-1256. https://doi.org/10.1016/j.compedu.2012.05.009	161	23
Huang, W. H., Huang, W. Y., & Tschopp, J. (2010). Sustaining iterative game playing processes in DGBL: The relationship between motivational processing and outcome processing. *Computers & Education*, *55*(2), 789-797. https://doi.org/10.1016/j.compedu.2010.03.011	139	24
Yang, Y. T. C. (2012). Building virtual cities, inspiring intelligent citizens: Digital games for developing students' problem solving and learning motivation. *Computers & Education*, *59*(2), 365-377. https://doi.org/10.1016/j.compedu.2012.01.012	126	18
Becker, K. (2007). Digital game-based learning once removed: Teaching teachers. *British Journal of Educational Technology*, *38*(3), 478-488. https://doi.org/10.1111/j.1467-8535.2007.00711.x	124	21
Hwang, G. J., & Wu, P. H. (2012). Advancements and trends in digital game-based learning research: a review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, *43*(1), E6-E10. https://doi.org/10.1111/j.1467-8535.2011.01242.x	121	22
Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An investigation of the interrelationships between motivation, engagement, and complex problem solving in game-based learning. *Journal of Educational Technology & Society*, *17*(1), 42-53. https://www.jstor.org/stable/jeductechsoci.17.1.42	109	11
All, A., Castellar, E. P. N., & Van Looy, J. (2016). Assessing the effectiveness of digital game-based learning: Best practices. *Computers & Education*, *92*, 90-103. https://doi.org/10.1016/j.compedu.2015.10.007	103	13

Among the cited publications, those with the highest connection strengths (cs) are, likewise, Marina Papastergiou's article titled "Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation" (cs=67), Severine Erhel and Eric Jamet's article titled "Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness" (cs=30), and Wen-Hao Huang, Wen-Yeh Huang, and Jill Tschoo's article titled "Sustaining iterative game playing processes in DGBL: The relationship between motivational processing and outcome processing" (cs=24).

Keywords

Data indicating the frequency of keywords used in scientific publications on the use of digital games in education are presented in the word cloud image below.

Figure 5. *Word cloud regarding the frequency of keywords used in scientific publications on the use of digital games in education*

Figure 5 shows that concepts such as digital game-based learning, game-based learning, digital games, serious games, game design, gamification, games, and learning were used the most in scientific publications on the use of digital games in education.

The general research areas determined based on the keywords of scientific publications on the use of digital games in education and the social network analysis of the relationships between these areas are shown in Figure 6.

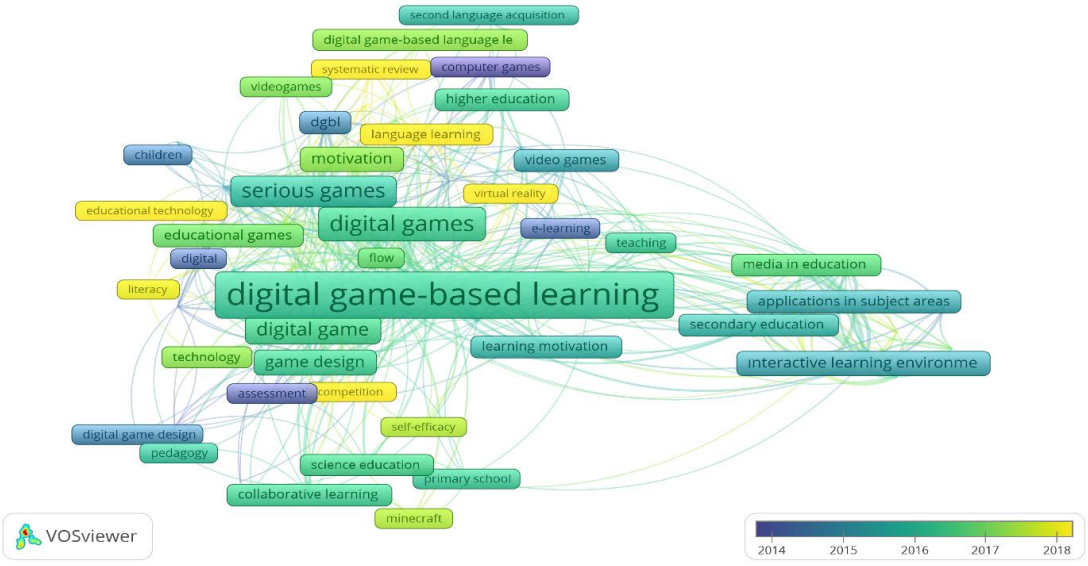

Figure 6. *Social network analysis of the keywords (Frame size shows the frequency of discussion of the topic, and yellow areas indicate their recentness)*

Based on the cluster analysis in the keyword social network graph, it is seen in Figure 6 that scientific publications on the use of digital games in education are grouped under 7 clusters. The most frequently used keywords in these clusters are digital game-based learning (f=147), game-based learning (f=111), digital games (f=70), serious games (f=52), game design (f=28), gamification (f=28), games (f=24), and learning (f=23). Among the keywords, the ones with the highest connection strength (cs) are digital game-based learning (cs=307), game-based learning (cs=257), digital games (cs=159), serious games (cs=136), and motivation (cs=76). The clusters connected by these connecting links are the focus of connection of interrelated clusters. While the close positioning of the items reveals the strength of the relationship between them, the large distance between the items represents the lack of

sufficient relationship and similarity between them. In addition, if the items are not connected by any connection strength, this means that there is no relationship between them (Doğan, Doğan & Aykan, p. 167).

Reference Co-Citation Network

The mapping for the reference co-citation network is shown in Figure 7. Upon selecting the minimum citation number of the cited reference as 5 on VOSviewer, 607 of the 20,032 cited references meet the threshold value. In the mapping, based on the citations received by the publications in the reference co-citation network, 5 clusters came out, with the red cluster consisting of 157 publications, green cluster 157, blue cluster 126, yellow cluster 89, and purple cluster 78.

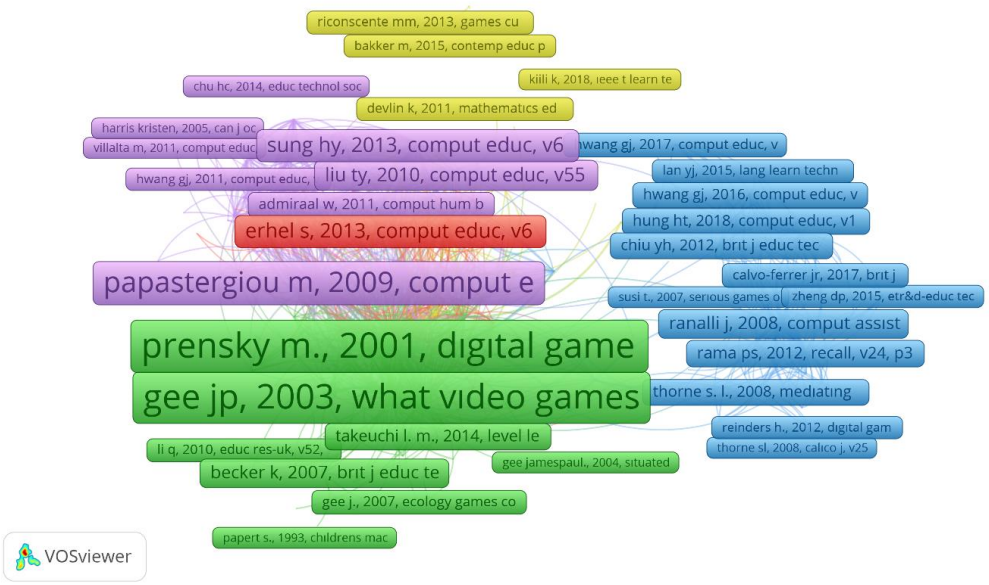

Figure 7. *Reference co-citation network analysis*

Table 7 presents, based on the reference co-citation network analysis, the publications with most co-citations among publications on the use of digital games in education, the number of citations, and connection strengths.

Table 7. *Most cited publications in the reference co-citation network, co-citation numbers (f), and connection strengths (cs)*

Cited Reference	f	cs
Prensky, M. (2003). Digital game-based learning. *Computers in Entertainment (CIE)*, *1*(1), 21-21.	124	1625
Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in Entertainment (CIE)*, *1*(1), 20-20.	119	1339
Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & education*, *52*(1), 1-12.	86	1433
Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & gaming*, *33*(4), 441-467.	74	1043
Van Eck, R. (2006). Digital game-based learning: It's not just the digital natives who are restless. *EDUCAUSE review*, *41*(2), 16.	63	871
Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & education*, *59*(2), 661-686.	62	1036
Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. *The Internet and higher education*, *8*(1), 13-24.	57	959
Han-Yu, S. ABD GWO-JEN, H., 2013. A collaborative game-based learning approach to improving students' learning performance in science courses. *Computer & Education*, *63*, 43-51.	39	845
Erhel, S., & Jamet, E. (2013). Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness. *Computers & education*, *67*, 156-167.	38	538
Prensky, M. (2003). Digital game-based learning. *Computers in Entertainment (CIE)*, *1*(1), 21-21.	38	397

Table 7 shows that among the studies published on the use of digital games in education, the most cited source is Marc Prensky's 2001 study titled "Digital game-based learning". It is understood that the said study is an important reference source with a high impact that directs the field of the use of digital games in education. Also, James Paul Gee's 2003 study titled "What video games have to teach us about learning and literacy", Marina Papastergiou's 2009 article titled "Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation", and Rosemary Garris, Robert Ahlers, and James E. Driskell's 2002 study titled "Games, motivation, and learning: A research and practice model" are the reference sources with the highest connection strengths.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This research aimed to make a bibliometric analysis of the studies on the use of digital games in education published between 2005-2021 and indexed in the WoS database. The bibliometric data of 760 academic studies in the "Education/Educational Research" and "Education Scientific Disciplines" categories out of 1,708 results reached through the search constituted the dataset of the study. The study found that years with most publications on the use of digital games in education were 2017, 2018, and 2020, respectively. A holistic evaluation of the years of publications shows an increase in the number of scientific publications on the use of digital games in education as of 2007. In parallel with this result of the research, Schöbel, Saqr, and Janson (2021) stated that the use of game concepts in digital learning environments started in 2000 and increased continuously, that the number of published articles increased every year from 2006 to 2009, and 2017 was the year with most articles published. Similarly, in their study on game-based learning in science and mathematics education, Chen, Hwang, Yeh, Chen, Chen, and Chien (2021) determined that only one article was published from 1991 to 2000, a period in which digital game-based learning research was developing, that an increase occurred from 2001 to 2010 with 11 articles, and that the number of publications tripled in 2012 relative to 2011. They also stated that most of the articles were published between 2015 and 2020. This may be associated with the increasing use of digital game environments as a result of the further diversification of learning environments along with the use of computers and the internet becoming widespread across the world in the early 2000s and, in parallel with that, the tendency of researchers in this field towards academic studies on the effect of technology applications on learning.

As to the languages of publication of studies on the use of digital games in education, English ranked first with a large percentage relative to others. It was followed by Portuguese and Spanish. The reason why English was the most frequent language of publication with a large percentage can be said to be the widespread use of English as the language of science and the language preferences of the journals indexed in the WoS database. Consistently with this result of the research, the literature includes bibliometric studies conducted in the field of education concluding that English is the most widely used language (Özkaya, 2019; Polat & Karakuş, 2021; Şeref & Karagöz, 2019; Yeşiltaş & Evci, 2021).

In terms of type of publication, majority of the studies on the use of digital games in education were found to be articles, which were followed by proceedings papers and reviews, respectively. The literature contains bibliometric studies conducted in the field of education obtaining similar results to this result of the research (Yeşiltaş & Evci, 2021; Şeref & Karagöz, 2019).

While the distribution of the authors of academic publications on the use of digital games in education was being examined by institution, only the top 10 institutions in terms of the number of publications were covered, since the number of institutions in that category was very high (654). In this context, National Taiwan University of Science and Technology, National Taiwan Normal University, and National Central University were detected to be the leading institutions of authors publishing on the use of digital games in education. Considering the Turkish Universities included in the list by ranking and number of publications, Anadolu University, Fırat University, Gazi University, İstanbul University, and Uludağ University were seen to be at the top of the list, respectively.

Taiwan, the USA, and the UK were the leading countries of publications on the use of digital games in education in WoS. This may be because these countries carry out various studies on digital learning as an education strategy. For example, Taiwan conducted a 10-year process from 2003 to 2012 aimed at promoting the development and adoption of the e-learning approach (Tsai, Chen & Chen, 2010). Similarly, the USA put into practice several National Education Technology Plans in 2010 and 2017 to benefit from the power of technology to rethink education and approach student learning in new ways (Dede, 2010; King & South, 2017). In the UK, there are important organizations that carry out studies for the integration of technology into education. Becta, one of them, leads the national movement to improve learning through technology. These results explain the higher number of publications on the use of digital games in these countries compared to others. In terms of cross-country collaboration based on the co-authorship analysis of the publications, the UK has the biggest number of connections. The UK is followed by the USA, China, and Spain. The UK, having the biggest number, collaborated with Italy and Spain the most, while the USA collaborated with China and Taiwan the most.

As to the yearly distribution of the citation numbers of academic publications on the use of digital games in education, the citations were low from 2005 to 2008, but after 2008, citation numbers went up with a rising rate of increase every passing year. This surge in citation numbers may be related to the increase in the number of scientific publications on this subject as a result of the widespread use and rising importance of digital games in education through advance of technology. Greek researcher Papastergiou's (2009) study, in which she evaluated the learning effectiveness and motivational appeal of computer games comparatively, ranks first with 739 citations. That the said study has the most citations though Greece ranks 6th in the country-based ranking of the academic publications in this field shows that the study has made a significant contribution to the field of use of digital games in education.

The word cloud regarding the frequency of keywords used in scientific publications on the use of digital games in education indicated that concepts such as digital game-based learning, game-based learning, digital games, serious games, game design, gamification, games, and learning were used the most. The general research areas determined based on the keywords of scientific publications on the use of digital games in education and the social network analysis of the relationships between these areas revealed that the scientific publications fell under 7 clusters. The most frequently used keywords in these clusters were digital game-based learning, game-based learning, digital games, serious games, game design, gamification, games, and learning. Among the keywords, the ones with the highest connection strengths were digital game-based learning, game-based learning, digital games, serious games, and motivation. The clusters connected by these connecting links constitute the focus of connection of interrelated clusters. Keywords in academic publications provide essential information to understand their main aspects. The inclusion of the concept of game design in the keyword frequency may be an indication that digital games are moving towards the digital game design process in learning environments as technology progresses. It can be stated that nowadays, with the increase in the use of software (Kodu Game Lab, Scratch, etc.) whereby students can design their own games, academic studies have turned to this field as well. It is known that games generally provide motivation in learning environments. Motivation is an important variable for digital game environments. This may be why it is frequently used as a keyword.

Considering the reference co-citation network of scientific publications on the use of digital games in education, the most cited source is Marc Prensky's (2001) study titled "Digital game-based learning". Citation number is important to reflect the author's contribution to the field. It is understood that the said study is an important reference source with a high impact that directs the field of the use of digital games in education. The reference sources with the highest connection strengths after that study are James Paul Gee's 2003 study titled "What video games have to teach us about learning and literacy", Marina Papastergiou's 2009 article titled "Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation", and Rosemary Garris, Robert Ahlers, and James E. Driskell's 2002 study titled "Games, motivation, and learning: A research and practice model". These publications have led the field of digital games.

All in all, this research examined a total of 760 academic studies published on the use of digital games in education between the years 2005-2021 and indexed in the WoS database and provided an overview of many components such as prominent publications, authors, countries, citation numbers, collaborations, types of publication, and keywords. Therefore, this research is expected to light the way for the related studies to be conducted in the field by reflecting the trends in the use of digital games in education. Based on the results obtained in the study, it can be recommended to conduct similar bibliometric analyses for different variables/different disciplines related to the subject in the WoS database or in different databases.

REFERENCES / KAYNAKÇA

Andres, A. (2009). How to undetake a bibliometric study. Chandos Publishing.

Baynal Doğan, T. G., Doğan, S., & Aykan, E. (2021). Liderlik tarzlarının bibliyometrik analizi. Erciyes Akademi, 35(1), 161-169.

Becta (2001). Computer games in education project: Findings report.

Byun, J., & Joung, E. (2018). Digital game-based learning for K–12 mathematics education: A meta-analysis. School Science and Mathematics, 118(3-4), 113-126.

Chadegani, A. A., Salehi, H., Yunus, M., Farhadi, H., Fooladi, M., Farhadi, M., & Ebrahim, N. A. (2013). A comparison between two main academic literature collections: web of science and scopus databases. Asian Social Science, 9(5), 18-26. http://dx.doi:10.5539/ass.v9n5p18

Chen, P. Y., Hwang, G. J., Yeh, S. Y., Chen, Y. T., Chen, T. W., & Chien, C. H. (2021). Three decades of game-based learning in science and mathematics education: an integrated bibliometric analysis and systematic review. Journal of Computers in Education,1-22. https://doi.org/10.1007/s40692-021-00210-y

Chen, C. H., Shih, C. C., & Law, V. (2020). The effects of competition in digital game-based learning (DGBL): a meta-analysis. Educational Technology Research And Development, 68(4), 1855-1873.

Cicchino, M. I. (2015). Using game-based learning to foster critical thinking in student discourse. Interdisciplinary Journal of Problem-Based Learning, 9(2). https://doi.org/10.7771/1541-5015.1481

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital games, design, and learning: A systematic review and meta-analysis. Review Of Educational Research, 86(1), 79-122.

Dede, C. (2010). Transforming schooling via the 2010 national educational technology plan. Teachers College Record.

Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, Motivation, and Learning: A Research and Practice Model. Simulation & Gaming, 33(4), 441–467. https://doi.org/10.1177/1046878102238607

Gee, J. P. (2003). What video games have to teach us about learning and literacy. Computers in Entertainment (CIE), 1(1), 20-20.

Gros, B. (2007). Digital games in education: The design of games-based learning environments. Journal of Research on Technology in Education, 40(1), 23-38.

Hwang, G. J., & Chen, P. Y. (2022). Interweaving gaming and educational technologies: Clustering and forecasting the trends of game-based learning research by bibliometric and visual analysis. Entertainment Computing, 40, 1-11. https://doi.org/10.1016/j.entcom.2021.100459

Karasar, N. (2016). Bilimsel araştırma yöntemi "Kavramlar ilkeler ve yöntemler" (27. baskı). Nobel.

King, J., & South, J. (2017). Reimagining the role of technology in higher education: A supplement to the national education technology plan. US Department of Education, Office of Educational Technology.

Özkaya, A. (2019). Stem eğitimi alanında yapılan yayınların bibliyometrik analizi. Bartın University Journal of Faculty of Education, 8 (2), 590-628. https://doi.org/10.14686/buefad.450825

Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. Computers & Education, 52(1), 1-12. https://doi.org/10.1016/j.compedu.2008.06.004

Polat, R., & Karakuş, U. (2021). Çevre eğitimi alanındaki makalelerin web of science veri tabanına dayalı bibliyometrik analizi. Anadolu Kültürel Araştırmalar Dergisi, 5(2), 131-145.

Prensky, M. (2001). Fun, play and games: what makes games engaging. Digital Game-Based Learning, 5(1), 5-31.

Prensky, M. (2003). Digital game-based learning. Computers in Entertainment (CIE), 1(1), 1-4. https://doi.org/10.1145/950566.950596

Pritchard, A. (1969). Statistical bibliography or bibliometrics. Journal of documentation, 25(4), 348-349.

Ritzhaupt, A., Poling, N., Frey, C. & Johnson, M. (2014). A synthesis on digital games in education: What the research literature says from 2000 to 2010. Journal of Interactive Learning Research, 25(2), 261-280.

Schöbel, S., Saqr, M., & Janson, A. (2021). Two decades of game concepts in digital learning environments–A bibliometric study and research agenda. Computers & Education, 173, 1-23. https://doi.org/10.1016/j.compedu.2021.104296

Sezgin, S., Binark F. M., Yalçın, H. & Bayraktutan, G. (2018). Türkiye'de dijital oyun çalışmalarının 10 yılı: bir Tubitak-Sobag araştırmasının boylamsal etki değerlendirmesi. Kültür ve İletişim, 21(42), 170-194.

Şeref, İ., & Karagöz, B. (2019). Türkçe eğitimi akademik alanına ilişkin bir değerlendirme: Web of science veri tabanına dayalı bibliyometrik inceleme. Dil Eğitimi ve Araştırmaları Dergisi, 5(2), 213-231.

Talan, T., Doğan, Y., & Batdı, V. (2020). Efficiency of digital and non-digital educational games: A comparative meta-analysis and a meta-thematic analysis. Journal of Research on Technology in Education, 52(4), 474-514.

Tsai, C. C., Chen, N. S., & Chen, G. D. (2010). The current status and future of e-learning in Taiwan. Innovations in Education and Teaching International, 47(1), 5-7.

Tsai, Y. L., & Tsai, C. C. (2020). A meta-analysis of research on digital game-based science learning. Journal of Computer Assisted Learning, 36(3), 280–294.

Van Eck, N. J., & Waltman, L. (2013). VOSviewer manual. Leiden: Univeristeit Leiden. 23 Nisan 2021 tarihinde, https://www.vosviewer.com/download/f-33t2.pdf adresinden erişildi.

Woo, J.-C. (2014). Digital game-based learning supports student motivation, cognitive success, and performance outcomes. Educational Technology & Society, 17(3), 291-307.

Wouters, P., Van Nimwegen, C., Van Oostendorp, H., & Van Der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. Journal of educational psychology, 105(2), 249.

Yeşiltaş, E., & Evci, N. (2021). Eğitimde bilgisayar okuryazarlığı çalışmalarının bibliyometrik bir analizi. Gazi Eğitim Bilimleri Dergisi, 7(3), 224-242. https://dx.doi.org/10.30855/gjes.2021.07.03.001

Zupic, I. & Cater, T. (2015). Bibliometric methods in management and organization. Organizational Research Methods, 18(3), 429-472. https://dx.doi:10.1177/1094428114562629

Eğitimde Dijital Oyun Kullanımına Yönelik Araştırma Eğilimleri

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Özet

Bu araştırmanın amacı eğitimde dijital oyun kullanımına yönelik araştırmaları bibliyometrik analiz yöntemi ile incelemektir. Araştırmada nitel araştırma desenlerinden betimsel tarama modeli tercih edilmiştir. Veri toplama aşamasında Web of Science (WoS) indekslerinde yer alan akademik çalışmalara ulaşılmıştır. Veri tabanında "digital game" anahtar kelimesi kullanılarak arama yapılmıştır. Arama kriteri olarak "doküman başlığı, özet, anahtar kelime" seçilmiştir. Araştırmaya 2005-2021 yılları arasındaki "Eğitim/Eğitim Araştırmaları" ve "Eğitim Bilim Disiplinleri" kategorilerinde yer alan 760 akademik çalışma dahil edilmiştir. Verilerin analizinde bibliyometrik analiz yöntemi kullanılmıştır. Araştırmada eğitimde dijital oyunların kullanımı ile ilgili olarak en fazla yayın yapılan yılların 2017 ve 2018 olduğu, en sık yayın yapılan dillerin başında İngilizce ve Portekizcenin geldiği, yayımlanan akademik çalışmaların büyük bir kısmını makalelerin oluşturduğu, yayın yapan yazarların çalıştığı ya da desteklendiği kurumların başında Ulusal Tayvan Bilim Teknoloji Üniversitesi'nin, Türk üniversitelerinden ise Anadolu Üniversitesi'nin geldiği, ilgili konuda en çok yayın yapılan ülkelerin başında Tayvan ve ABD'nin olduğu, 2008 yılı sonrasında ise konuya ilişkin yayınlara yapılan atıf sayısının arttığı, dijital oyun kullanımı ile ilgili yapılan bilimsel yayınlarda en çok dijital oyun tabanlı öğrenme, oyun tabanlı öğrenme, dijital oyunlar vb. anahtar kelimelerinin kullanıldığı bulgularına ulaşılmıştır. Araştırma sonucunda eğitimde dijital oyun kullanımına alanında birçok bileşene yönelik genel bir tablo ortaya koyulmuştur. Çalışmanın bulgularına dayalı olarak gelecekteki çalışmalara referans olabileceği düşünülmektedir.

Anahtar Kelimeler: Eğitim, Dijital oyun, Bibliyometrik analiz, Web of science

E-Uluslararası Eğitim Araştırmaları Dergisi

Cilt: 13, No: 4, ss. 40-56

Araştırma Makalesi

Gönderim: 2022-04-22
Kabul: 2022-06-14

Önerilen Atıf

Yeşiltaş, E. ve Cevher, S. (2022). Eğitimde dijital oyun kullanımına yönelik araştırma eğilimleri, *E-Uluslararası Eğitim Araştırmaları Dergisi,* 13(4), 40-56. DOI: https://doi.org/10.19160/e-ijer.1107500

Genişletilmiş Özet

Problem: Dijital oyunların eğitim ortamlarında kullanımına yönelik bilimsel çalışmalar teknolojinin gelişmesi ve ilerlemesine paralel olarak 2000'li yılların ortalarında artış göstermeye başlamıştır. Bu artışla birlikte eğitimde dijital oyun kullanımına yönelik araştırma eğilimlerinin ne yönde ilerlediğine ve gelecekteki çalışmaların hazırlanmasında hangi noktalara dikkat edilmesi gerektiğine dair soruların cevaplanması adına çalışma alanının durumunu ortaya koyan bibliyometrik çalışmalara ihtiyaç duyulmaya başlanmıştır. Bibliyometrinin amacı, temel olarak belirli bir alandaki bilimsel alanyazını değerlendirmek, dolayısıyla her türlü disipline geniş bir perspektif sağlamaktır (Andres, 2009).

Eğitimde dijital oyun kullanımı üzerine yapılan çalışmaların bibliyometrik analizini ortaya koyan kapsamlı bir araştırmaya literatürde rastlanmamıştır. Dijital oyunlara yönelik teknolojilerin gelişmesi ve artması bu araştırmalara gün geçtikçe ilgi duyulması oluşan bilgi birikiminin yorumlanmasını gerekli kılacağı için bu araştırmalara ihtiyaç duyulmaktadır. Bu doğrultuda araştırmanın amacı 2005-2021 yılları arasında eğitimde dijital oyun kullanımı üzerine yayınlanan ve Web of Science (WoS) veri tabanında indekslenen yayınları bibliyometrik olarak analiz etmektir. Araştırmanın amacı doğrultusunda eğitimde dijital oyun kullanımı üzerine yayımlanan akademik çalışmaların yıllara göre sayısal dağılımı, yayınlandıkları dillere göre dağılımları, yayın türlerine göre dağılımları, yazarlarının çalıştığı kurumlara göre dağılımları, yayımlandığı ülkelere göre dağılımları, yıllara göre atıf sayıları, çalışmalarda en sık kullanılan anahtar kelimeler ve yayınların referans ortak atıf ağı dağılımı incelenmiştir.

Yöntem: Bu araştırmada eğitimde dijital oyunların kullanımıyla ilgili akademik araştırmalar bibliyometrik parametreler açısından incelenip mevcut durum ortaya koyulmak istendiği için betimsel tarama deseni benimsenmiştir. Çalışmanın veri toplama aşamasında Web of Science (WoS) veritabanları kullanılmıştır. Çalışma sürecinde Web of Knowledge Web sayfasında tüm WoS veri tabanlarında "digital game" anahtar kelimesi kullanılarak araştırma başlıklarında arama yapılmıştır. Arama kriteri olarak "doküman başlığı, özet, anahtar kelime" seçilmiştir. Çalışma bütüncül bir yoruma ulaşılabilmek amacıyla veritabanında ulaşılabilen en eski tarihten başlatılarak 2005-2021 yılları arasındaki 16 yıllık zaman dilimini kapsayacak şekilde gerçekleştirilmiştir. Arama sonucunda ulaşılan 1708 sonuçtan "Eğitim/Eğitim Araştırmaları" ve "Eğitim Bilim Disiplinleri" kategorilerinde yer alan 760 akademik çalışmaya ait bibliyometrik veri, çalışmanın veri seti olarak kullanılmıştır. Çalışmada veri analizi tekniği olarak bibliyometrik analiz kullanılmıştır.

Çalışmada 2005'den 2021'e kadar olan dönemde eğitimde dijital oyunların kullanımıyla ilgili olarak yayınlanmış olan toplam 760 yayın, bibliyometrik göstergeler açısından incelenerek kategorize edilmiştir. Kategorize edilen verilere ilişkin yüzde ve frekanslar hesaplanmıştır. Bu hesaplamalar için MS Excel uygulaması kullanılmıştır. Çalışma kapsamında incelenen akademik yayınların araştırma konuları ve yönelimleri yayınlardaki anahtar kelimeler üzerinden görsel olarak haritalandırılmıştır. Bu doğrultuda WordArt çevrimiçi kelime bulutu yazılımı tercih edilmiştir. Eğitimde dijital oyunların kullanımıyla ilgili 760 akademik çalışmanın anahtar kelimelerinin sosyal ağ analizi bibliyometrik analiz araçlarından VOSviewer (Version 1.6.16) paket programı aracılığıyla görselleştirilmiştir.

Bulgular: Araştırma sonuçlarına göre, eğitimde dijital oyunların kullanımına yönelik yapılan çalışmaların yıl bazlı dağılımları incelendiğinde; en fazla yayın yapılan yıllar, sırasıyla 2017, 2018 ve 2020 yıllarıdır. Yayın yapılan yıllar bir bütün olarak değerlendirildiğinde; 2007 yılı ve sonrasında eğitimde dijital oyunların kullanımıyla ilgili yayımlanan bilimsel yayınların sayısında artış olduğu görülmektedir. Akademik yayınlar yayın dili bakımından değerlendirildiğinde; ilk sırada %96,45 gibi büyük bir oranda İngilizce dili yer almaktadır. İngilizceyi Portekizce (%1,71) ve İspanyolca (%0,79) dilleri takip etmektedir. Çalışmaların büyük bir kısmının makalelerden oluştuğu sonrasında en sık yayın yapılan diğer türlerin ise sırasıyla bildiri ve derleme makale olduğu görülmektedir. Akademik yayınların yazarlarının çalıştığı kurumlara göre dağılımları incelendiğinde; yazarların kurumlarının başında Ulusal Tayvan Bilim Teknoloji Üniversitesi, Ulusal Tayvan Normal Üniversitesi ve Ulusal Merkez Üniversitesi yer almaktadır. Kurumlara ilişkin yapılan arama sonucunda listede yer alan Türk Üniversiteleri ve bu üniversitelerin sıralamaları ve yayın sayılarına bakıldığında ise listenin başında sırasıyla; Anadolu Üniversitesi, Fırat Üniversitesi, Gazi Üniversitesi'nin geldiği görülmektedir. Yayın yapılan ülkelerin başında Tayvan, Amerika Birleşik Devletleri ve İngiltere'nin geldiği görülmektedir. Yapılan yayınların ortak yazarlık analizinde ülkelerarası iş birliğinde

ise; bağlantı sayısına göre İngiltere en yüksek sayıya sahiptir. İngiltere'yi ABD, Çin ve İspanya takip etmektedir.

Eğitimde dijital oyunların kullanımıyla ilgili yayımlanan akademik yayınların yıllara göre aldığı atıflar incelendiğinde; 2005'ten 2008'e kadar atıflarının düşük oranda seyrettiği, 2008 yılı sonrasında ise her geçen yıl artan bir oranda atıf sayısının arttığı görülmektedir. Anahtar kelimelerin sıklığına ilişkin kelime bulutunda; en çok dijital oyun tabanlı öğrenme, oyun tabanlı öğrenme, dijital oyunlar, ciddi oyunlar, oyun tasarımı, oyunlaştırma, oyunlar ve öğrenme gibi kavramların kullanıldığı görülmektedir. Yayınların referans ortak atıf ağı incelendiğinde; en çok atıfı alan kaynağın Marc Prensky tarafından yazılan ve 2001 yılında yayımlanan "Digital game-based learning" isimli çalışma olduğu görülmektedir.

Sonuç ve Öneriler: Sonuç olarak bu araştırma ile 2005-2021 yılları arasında WoS veri tabanında eğitimde dijital oyun kullanımına yönelik toplam 760 bilimsel yayın incelenerek bu alanda öne çıkan yayın, yazar, ülke, atıf sayısı, işbirlikleri, kaynak türleri, anahtar kelimeleri olmak üzere birçok bileşene ilişkin bir özet ortaya koyulmuştur. Bu doğrultuda yapılan araştırmanın, eğitimde dijital oyun kullanımına ilişkin eğilim ve trendleri yansıtarak alanda yapılacak ilgili çalışmalara ışık tutacağı düşünülmektedir. Çalışmada elde edilen sonuçlardan yola çıkarak Web of Science veri tabanında ya da farklı veri tabanlarında konuya ilişkin farklı değişkenlere/farklı disiplinlere yönelik benzer bibliyometrik analizler yürütmesi önerilebilir.