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Bibliometric Mapping of Gamification in Education

Eğitimde Oyunlaştırmanın Bibliyometrik Haritalandırılması

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Abstract

This study aims to reveal the research trend in the field of gamification in education with co-authorship, bibliographic matching, collaboration and citation analysis, taking into account variables such as author, publication, keyword, journal, country, university, number of publications and citations. VOSviewer software was used for bibliometric analysis. As a result of the bibliometric analysis, it has been determined that the most effective countries in terms of studies on gamification in education are the USA, Spain and Bulgaria. According to the keyword co-occurrence analysis, it was determined that keywords such as gamification, motivation, game elements and educational innovation came to the fore. The use of gamification in education has some important effects such as motivation, learning success, interaction, competition and innovation. Current research provides the most relevant theoretical contributions from an innovative technique in the field of bibliometric research. In addition, it can be said that the results of the study are not only aimed at the academic community, but also addressed to educators and politicians in order to identify trends in research on gamification in education, design effective policy tools and ultimately improve education and training environments. The results show that research on gamification in education is focused on current developments.

Anahtar Kelimeler: Gamification, Educational innovation, Bibliometric mapping

Özet

Bu çalışma, yazar, yayın, anahtar kelime, dergi, ülke, üniversite, yayın ve atıf sayısı gibi değişkenler dikkate alınarak ortak yazarlık, bibliyografik eşleşme, birlikte çalışma ve atıf analizleri ile eğitimde oyunlaştırma alanındaki araştırma eğilimini ortaya koymayı amaçlamaktadır. Bibliyometrik analiz için VOSviewer yazılımı kullanılmıştır. Bibliyometrik analiz sonucunda eğitimde oyunlaştırma alanına ilişkin yapılan çalışmalar açısından en etkili ülkelerin ABD, İspanya ve Bulgaristan olduğu belirlenmiştir. Anahtar kelime eş oluşum analizine göre gamification, motivation, game elements ve educational innovation gibi anahtar kelimelerin öne çıktığı belirlenmiştir. Eğitimde oyunlaştırmanın kullanılması motivasyon, öğrenme başarısı, etkileşim, rekabet ve inovasyon gibi bazı önemli etkileridir. Mevcut araştırma, bibliyometrik araştırmalar alanında yenilikçi bir teknikten en alakalı teorik katkıları sağlar. Ek olarak çalışmanın sonuçları yalnızca akademik topluluğa yönelik olmayıp, aynı zamanda eğitimde oyunlaştırma konulu araştırmaların eğilimlerinin belirlenmesi, etkili politika araçları tasarlanması ve nihayetinde eğitim ve öğretim ortamlarının iyileştirilmesi amacıyla eğitimcilere ve politikacılara da hitap ettiği söylenebilir. Sonuçlar eğitimde oyunlaştırmayla ilgili araştırmaların güncel gelişmeler odağında ele alındığını göstermektedir.

Keywords: Oyunlaştırma, Eğitimsel yenilik, Bibliyometrik haritalama

Extended Summary

Giriş

Teknolojik hızlı gelişimiyle birlikte öğrencilerin artan eğitim ihtiyaçlarını karşılamak için her zaman yeni ve heyecan verici yollar aranmıştır. Son yıllarda oyun öğelerinin oyun dışı ortamlarda kullanılması eğilimine gidilmiştir. Eğitimin oyunlaştırılması, oyun öğelerinin eğitim ortamına dahil edilerek öğrencilerin katılımlarını artırmaya yönelik bir stratejidir (Dichev & Dicheva, 2017). Oyunlaştırma kavramı için evrensel bir tanım olmamasına rağmen, oyunla ilgili olmayan ortamlarda veya bağlamlarda kullanıcıların katılımını artırmak için video oyunu bileşenlerinin kullanımı olarak adlandırılmaktadır (Hamari vd., 2014). Eğitimde oyunlaştırmanın amacı, tabletler, akıllı telefonlar veya bilgisayarlar gibi dijital cihazların kullanımıyla öğrencilerin eğitim ve öğretim ortamlarına dijital olarak katılımlarını artırmaktır (Klock ve diğerleri, 2012). Eğitimde oyunlaştırmanın ana hedefleri ise belirli yetenekleri geliştirmek, hedefleri tanıtmak, öğrencilerin ilgisini çekmek, öğrenmeyi optimize etmek, davranış değişikliğini desteklemek ve sosyalleşmektir (Knutas ve diğerleri,

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2014). Bu bağlamda eğitimin oyunlaştırılması öğrencilerin etkin katılımını sağlayarak eğitim ve öğretim faaliyetlerinin çıktısını istendik düzeye gelmesine yardımcı olabilir.

Oyunlaştırma kelimesi 2002'de ortaya çıksada bu kavram ilk olarak 2011 yılında literatürde popüler olmuştur. Bu tarihten itibaren bazı araştırmacılar (Dichev & Dicheva, 2017), oyunlaştırmanın pedagojik alana dâhil edilmesinin birçok fayda sağladığını ileri sürmüştür. Dahası oyun öğelerinin yapabileceği etkileri dikkate alan birçok araştırmacı, oyunlaştırmanın eğitim bağlamındaki sonuçlarını araştırmıştır (Hakulinen ve Auvinen, 2014; Tvarozek ve Brza, 2014). Eğitimin oyunlaştırılması, belirli becerileri geliştirmek ve öğrenmeyi optimize etmek için, oyunların yapabileceğine benzer şekilde öğrencilerin katılım düzeylerini artırabileceği belirtilmektedir (Smiderle ve diğerleri, 2020). Oyunlaştırma, öğrencileri derslere katılmaya motive edebilir, öğretmenlere öğrencileri yönlendirmek ve ödüllendirmek için daha iyi araçlar sunabilir ve öğrenme sürecini eğlenceli bir deneyime dönüştürebilir (Yıldız ve diğerleri, 2021). Mayer (2005) yaptığı çalışmada, oyunlarla ilgili dijital bir ortamda "yaparak öğrenmenin" öğrencilerin aktif olarak katılmalarına ve daha anlamlı deneyimler yaşamalarına neden olduğunu belirtmektedir.

Eğitimde oyunlaştırma kavramının daha iyi anlaşılması ve yapılan çalışmaların incelenmesi amacıyla sistematik derleme çalışmalarının yapıldığı görülmektedir (Dichev ve Dicheva 2017; Behl ve diğerleri, 2022). Sistematik derlemeler belli bir konuda hazırlanmış araştırma sorusuna yanıt bulmak için, belirlenmiş kriterlere uygun olarak o alanda yayınlanmış orijinal çalışmaların sistemli bir biçimde incelenmesiyle oluşmaktadır. Betimsel bir bakış açısıyla yapılan sistematik derlemeler, genel eğilim ve ortak yazar analizleri ile sınırlı kalmaktadır. Dahası sistematik derlemeler atıf, ortak atıf ve kelime analizleri gibi bibliyometrik verileri içermemektedir. Bibliyometrik analiz atıf oranları gibi istatistiksel yöntemlerle dergilerin veya yazarların akademik kalitesini nicel olarak değerlendilmesidir (IGI, 2022). Bu bağlamda eğitimde oyunlaştırmanın bibliyometrik haritalamasının yapılması ilgili literatürün belli bir sistematikte görselleştirilmesi, yazarların ve yayınların arasındaki ilişkinin analiz edilmesi gelecekte yapılacak çalışmalara yön vermesi açısından önemli olabilir. Bu bilgiler doğrultusunda, belirlenen ve araştırmaya yön veren sorular aşağıdaki şekilde belirlenmiştir:

- Yayınların türüne, yazım diline ve ülkelerine göre dağılımı nasıldır?
- En etkili yazarlar kimlerdir?
- En çok atıf yapılan kurum, dergi ve ülkeler hangileridir?
- En çok atıf alan yayınların yıllara göre atıf dağılımı nasıldır?
- Ortak yazarlık ilişki haritası nasıldır?
- Anahtar kelimelerin dağılımı ve eğilimi nedir?
- En çok yayına sahip ülkelerin ısı diyagramı nasıldır?
- En çok alıntı yapılan yazarlar ve ilişkileri nasıldır?
- Yıllara göre en çok alıntı yapılan ülkeler ve oluşturdukları ilişkisel ağ haritası hangileridir?
- Ortak atıf durumlarına göre en çok hangi yazarlara atıf yapılmaktadır?

Yöntem

Bu araştırma, nicel araştırma yöntemi kullanılarak eğitimde oyunlaştırma konularında yapılmış alanyazındaki çalışmalara bibliyometrik analiz yöntemleriyle incelemeye çalışmaktadır. Çalışmada herhangi bir yıl kısıtlaması yapılmadan Web of Science (WoS) tarafından sağlanan bilimsel veriler kullanılarak eğitimde oyunlaştırma konularında yapılmış çalışmalar incelenmiştir

Sonuç, Tartışma ve Öneriler

Araştırmanın sonuçları, eğitimde oyunlaştırma alanında en fazla yayının İspanya, ABD (Amerika Birleşik Devletleri) ve Brezilya'da yapıldığı belirlenmiştir. Buna ek olarak İspanya ve ABD'nin önemli ölçüde atıf aldığı görülürken, Brezilya'nın yayın sayısına göre atıf sayısının dramatik biçimde az olduğu belirlenmiştir. Araştırmanın bir diğer sonucu ilgili alanda en fazla atıf alan yazarların ABD'deki Winston-Salem State Üniversitesi'nde görev yapan Dichev ve Dicheva olduğudur. Bununla birlikte eğitimde oyunlaştırma alanında en fazla atıf alan ülkenin de ABD olduğu görülmektedir. Atıfların sayısı, bir makalenin etkisini veya önemini tahmin etmek için kullanılan bir ölçüttür (Yank & Lee, 2013). Dahası akademik camiada bir işe kabul edilme ya da işte yükselmede atıflardan yararlanıldığı da bilinmektedir (Borgman ve Furner 2002). Bu bağlamda atıfların yüksek olması önemli bir kriter olarak görülebilir. Brezilya'daki yayın sayısının fazla olmasına karşın atıf sayısının az olması yapılan çalışmaların etkisinin zayıf olduğuna yönelik bir bulgu olarak değerlendirilebilir. Bununla birlikte Brezilya'da yayınlanan çalışmaların çoğunluğunun Brezilya'daki dergilerde yayınlanması da atıf sayısının az olmasının bir nedeni olarak görülebilir. Araştırmanın sonuçları eğitimde oyunlaştırma alanında yapılan çalışmaların teknoloji alanlarına odaklanan dergilerde yayınlandığını göstermektedir. Özellikle bu dergilerin son on yılda etkilerini artırdıkları söylenebilir. Bunun bir nedeni teknolojinin eğitim ve öğretim ortamlarında sıklıkla kullanılması olduğu düşünülmektedir. Yaşar ve Alkan (2019) dijital yerli öğrencilerin neredeyse tamamının, eğitim ve öğretim ortamlarında yeni teknolojileri kullanacağını belirtmektedir. Bu durumun bir sonucu olarak, özellikle gelişmiş ülkelerde, dijital oyun kullanımına atfedilen önem giderek artmaktadır. Bu durum teknoloji destekli oyunların eğitim ve öğretimde yaygınlaşmasıyla sonuçlanabileceği düşünülmektedir. Dolayısıyla son zamanlarda eğitimde oyunlaştırmanın teknolojiyle

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entegre olması yapılan yayınların eğitim ve teknoloji dergilerinde yayınlanmasıyla sonuçlanmaktadır. Araştırmanın bir diğer bulgusu en çok ortak alıntı yapılan yazarların ağ haritasının dağınık bir yapıda olmasıdır. Haritanın daha az dağınık olması ve dairelerin birbirine yakın olması, ilgili kümelerdeki araştırmacıların benzer çalışmalarda daha fazla alıntı yapma olasılığına işarettir. Ayrıca araştırmacıların aynı kümelerde olmaları ve birbirlerine yakın olmaları benzer konularda araştırma yaptıkları şeklinde yorumlanır (Van Eck & Waltman, 2020). Bu doğrultuda eğitimde oyunlaştırma konusunda önde gelen yazarların benzer çalışmalar yaptıkları söylenebilir. Bunun dışında bir grup Asyadaki bilim adamlarının ilgili alanda farklı konular çalıştığı görülmektedir. Mevcut araştırma, bibliyometrik araştırmalar alanında yenilikçi bir teknikten en alakalı teorik katkıları sağlar. Ek olarak çalışmanın sonuçları yalnızca akademik topluluğa yönelik olmayıp, aynı zamanda eğitimde oyunlaştırma konulu araştırmaların eğilimlerinin belirlenmesi, etkili politika araçları tasarlanması ve nihayetinde eğitim ve öğretim ortamlarının iyileştirilmesi amacıyla eğitimcilere ve politikacılara da hitap ettiği söylenebilir.

Introduction

Technological advances and their rapid development always create new and exciting ways to engage students to learn and meet their growing educational needs (Kalogiannakis et al., 2021). In recent years, there has been a trend towards incorporating game elements into non-game facilities. Gamification of education is a strategy to increase participation by incorporating game elements into an educational setting (Dicheva et al., 2015). Unlike Game-Based Learning, gamification is not using games to teach and fulfill educational goals, but instead using game elements to direct, reward, and learning motivation (Torres-Toukoumidis et al., 2021). Initially, gamification was applied in computer science and information technology. It then gradually entered disciplines derived from the social sciences, such as psychology (Landers & Callan, 2011). In this context, gamification of education can help the output of education and training activities reach the desired level by ensuring the active participation of students.

Although there is no universal definition for gamification, it is referred to as the use of video game components to increase user engagement in non-gaming environments and contexts (Hamari et al., 2014). Gamification aims to ensure the active participation of students digitally through the use of certain platforms or applications through digital devices such as tablets, smartphones, or computers (Klock et al., 2012). The main goals of gamification in education are to develop specific abilities, promote goals, engage students, optimize learning, support behavior change, and socialize (Knutas et al., 2014; Dichev & Dicheva, 2017). There is increasing evidence that gamification can increase learning motivation, students' subject matter expertise, and attitudes towards lifelong learning (Gatti et al., 2019).

Although the word gamification first appeared in 2002, the concept became popular in the scientific literature in 2011. Since then, many researchers (Dichev & Dicheva, 2017; Parra-González, 2020) have argued that the inclusion of gamification in the pedagogical field provides many benefits. Moreover, many researchers investigating the effect of gamification in the context of education have obtained positive results such as increasing participation in the course, keeping the user active, and increasing knowledge and cooperation (Hakulinen & Auvinen, 2014; Tvarozek & Brza, 2014). In addition, gamification of education is important for developing specific skills and optimizing learning and increasing student engagement levels (Smiderle et al., 2020). Gamification can motivate students to attend classes, give teachers better tools to guide and reward students, and make learning a fun experience (Yıldız et al., 2021). Furthermore, it is stated that "learning by doing" in a digital environment about games causes students to participate actively and have more meaningful experiences (Mayer, 2005).

The fundamentalc omponents of a gamified application include mechanisms designed for participants to interact with the game environment (Deterding et al., 2011). These mechanisms consist of structures such as digital scores, badges and leaderboards (Hamari & Koivisto, 2015). Users can receive digital points, commonly known as points, that can be used as status indicators to gain access to certain materials or spend on virtual products or gifts (Bunchball, 2016). Badges are icon-like displays that represent an individual's achievements. Leaderboards, on the other hand, are high-scoring tables that show a user's performance compared to other users. Points, badges, and leaderboards are external reward mechanisms that encourage repetition of desired behavior as they all provide positive reinforcement (Balcı, 2022).

It is seen that systematic compilation studies are carried out in order to better understand the concept of gamification in education and to examine the studies. (Behl et al., 2022; Manzano-León et al., 2021). Systematic reviews consist of systematically examining the studies published in the relevant field in accordance with the determined criteria in order to find an answer to the research question prepared on a

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particular subject. Systematic reviews from a descriptive perspective are limited to the general trends and co-author analyzes. Moreover, systematic reviews do not include bibliometric data such as citation, co-citation, and word analysis. In this context, bibliometric mapping of gamification in education may be important in terms of visualizing the relevant literature in a certain systematic and analyzing the relationship between authors and publications in terms of guiding future studies. In this direction, the current research can contribute to the literature in terms of revealing the general status of gamification studies in education published in international indexed journals (WoS: SSCI, SCI-Expanded, AHCI, and ESCI) with the help of bibliometric analyzes and visual maps. From this point of view, based on the publication and citation data obtained from the WoS database, it is aimed to close this gap in the literature by making a general situation analysis regarding the current trends of the researches in the field of gamification in education. More specifically, this study can contribute to determining the momentum of publication and citation data on gamification research in education, as well as revealing important journals and the most influential research in this field. In line with this information, the questions that were determined and guided the research were determined as follows:

- What are the distribution of publications by their type of document, language, and country?
- Who are the most influential authors?
- Which are the most cited institutions, journals and countries?
- What are the citation distribution of the most cited publications by years?
- What is the status of co-authorship?
- What is the distribution and trend of keywords?
- What is the temperature diagram of the countries with the most number of documents?
- What are the most cited authors and the view of their relationships?
- What are the most cited countries and the relational network map they created by years?
- What is the position of researchers to cite similar publications?

Method

The aim of this study is to provide an overview of all studies in the literature on gamification in education using quantitative research methods, with bibliometric analysis. In the study, studies on gamification in education were examined by using the scientific data provided by Web of Science (WoS) without any year restriction. As a result of the scanning, the research data obtained from the literature were made using the most frequently used keywords, the most cited publications, journals, countries and the relational maps of the most cited authors using the bibliometric analysis method.

Generation of the dataset

The data of the current research were obtained as a result of the scanning carried out on the WoS database on 14 June 2022. In this study, seven citation indexes in the WoS database were used: Conference Proceedings Citation Index-Social Science & Humanities (CPCI-SSH), Conference Proceedings Citation Index-Science (CPCI-S), Social Sciences Citation Index (SSCI), Emerging Sources Citation Index (ESCI), Science Citation Index Expanded (SCI-Expanded), Arts & Humanities Citation Index (A& HCI), and Book Citation Index-Social Sciences & Humanities (BKCI-SSH). In order to reach researches on gamification in education, advanced search methods in the WoS database and the keywords obtained as a result of the literature review are as in Figure 1.

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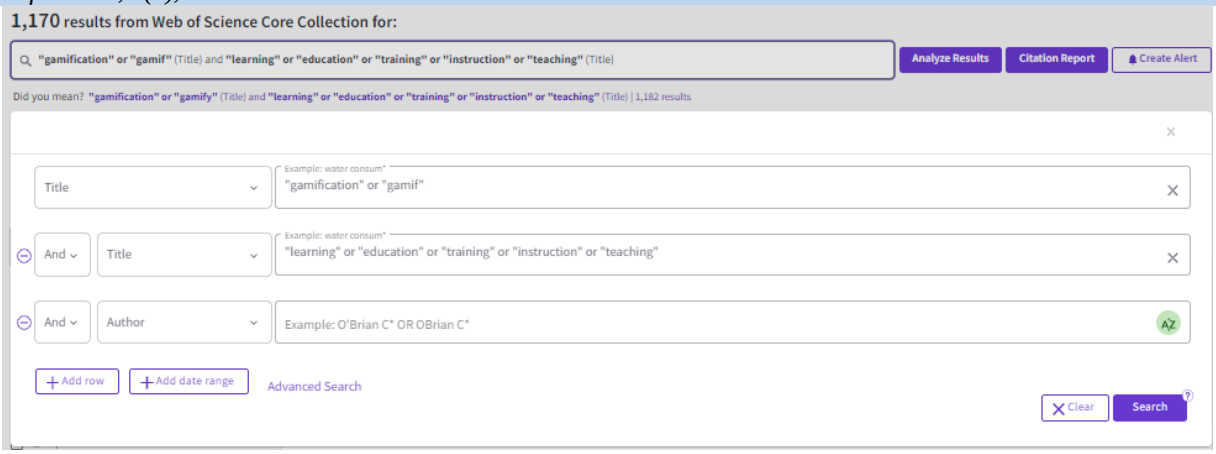

Figure 1. Search Query String

When Figure 1 is examined, ["gamification" or "gamif" (Title) and "learning" or "education" or "training" or "instruction" or "teaching" (Title)) in the Web of Science (WoS) database.

Data analysis

The data for a total of 1170 publications were accessed by scanning for topics according to the predetermined concepts. The obtained data were downloaded as "tab limited file" and "excel" files. The data of the publications were analyzed using the free bibliometric analysis software "VOSViewer (Visual Similarity)", which is widely used around the world.

Results

Descriptive results

First of all, the distribution of the publications included in the bibliometric analysis according to the publication type, language and country was examined in line with the purpose of the research. The distribution of the publications by publication type, language and countries is given in Table 1. When Table 1 was examined, it is seen that most of the research on gamification in education in the WoS database consists of Articles (N=520, f=41.47%) and Papers (N=500, f=39.87%). In addition, publications were generally published in English (N=1023, f=87.44%). Moreover, the majority of publications appear to have been published in Spain (N=239, 20.43%), USA (N=109, 9.32%) and Brazil (N=87, 7.44%).

Table 1. The Distribution of Publications by Their Type of Document, Language, and Country

Research Type		N	f (%)
1	Articles	520	41.47
2	Proceedings Papers	500	39.87
3	Book Chapters	54	4.31
4	Review Articles	49	3.91
5	Meeting Abstracts	25	1.99
6	Editorial Materials	20	1.59
7	Other	2	0.16
Research Language			
1	Engilish	1023	87.44
2	Spanish	115	9.83
3	Portuguese	28	2.39
4	Other	4	0.34
Countries (Top 10)			
1	Spain	239	20.43
2	USA	109	9.32
3	Brazil	87	7.44
4	England	57	4.87
5	Germany	53	4.53
6	Malaysia	48	4.10
7	Indonesia	45	3.85
8	China	43	3.68
9	Portugal	39	3.33
10	Other	450	38.46

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Within the scope of the current study, 1170 publications were examined. When the changes in the publications according to the years were examined, it is seen that the publications on gamification in education started to be published in 2011 (Figure 2). When the intensity of the publications was examined by years, it can be said that there was an increasing trend. When the change in the number of citations was examined, it was observed that a multivariate graph was formed. It can be said that there has been an increase in the number of citations in parallel with the increase in publications on gamification in education.

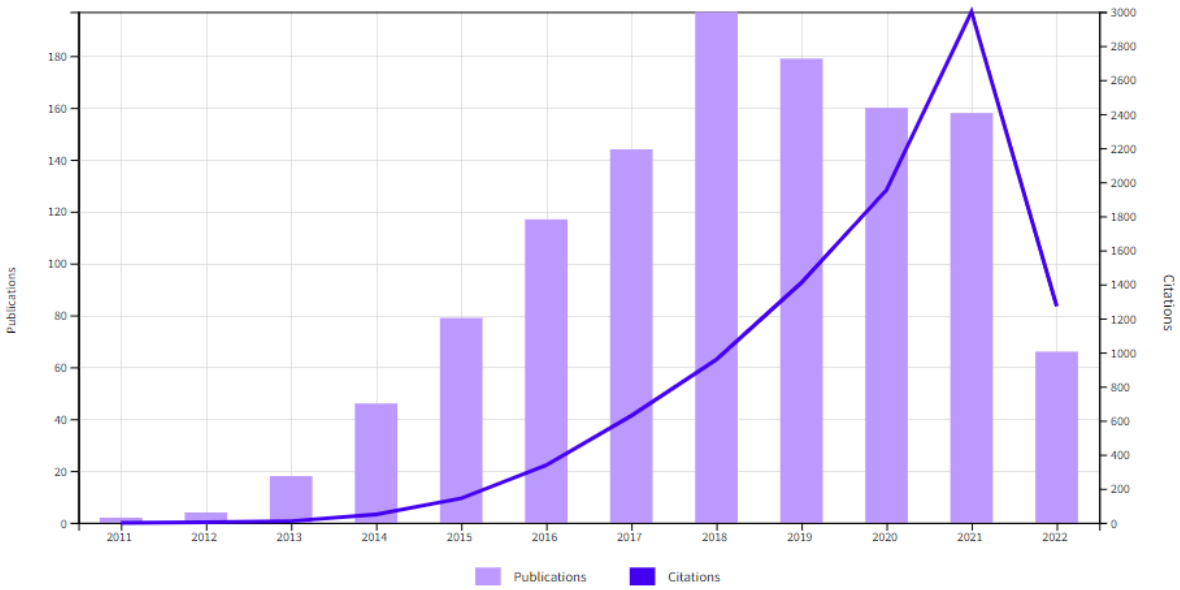

Figure 1. *Times Cited and Publications Over Time*

Bibliometric results

According to the VOSviewer guideline, each link has a strength represented by a positive numerical value. The higher this value, the stronger the link. The total link strength (TLS) characteristic refers to the total strength of a particular researcher's co-authoring links with other researchers) was examined (Table 2). Among the authors who have at least 1 study in the relevant indexes within the scope of the study, the top 10 authors according to the number of citations are given in Table 2. Darina Dicheva, Christo Dichev, Gennady Agre, and Galia Angelova are prominent authors in research on gamification in education. At the same time, it was determined that the relevant authors had the highest TLS in this field. This situation can be accepted as an indication that the author has collaborated with many authors from different regions.

Table 2. Author Rankings (The Most Cited 10 Authors)

Rank	Author	Document	Citations	TLS
1	Dichev, C.	4	650	337
2	Dicheva, D.	4	650	337
3	Agre, G.	2	629	324
4	Angelova, G.	2	629	324
5	De-Marcos, L.	3	423	322
6	Diaz R. R.	1	356	193
7	Fernandez V. A.	1	356	193
8	Simoes, J.	1	356	193
9	Landers, R. N.	4	320	148
10	Hew, K. F.	6	310	244

The findings regarding the ranks, article numbers, and total link strengths of the institutions of the most cited authors were presented in Table 3. Winston-Salem State University appears to be the most cited institution in this field. It was seen that researchers such as Dichev, C. and Dicheva, D. at this university are the leading authors in terms of their publications (N=4) and the number of citations (Cited=650). Secondly, the publications conducted in the Bulgarian Academy of Sciences stand out in terms of the number of citations

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(Cited = 630). As a matter of fact, the most cited authors such as Gennady Agre and Galia Angelova works at this university. Hong Kong University was one of the most cited educational institutions. It was seen that the author working at this university is Khe Foon Hew, who ranks tenth among the most cited authors. When examined in terms of TLS, it was determined that Winston-Salem State University and Bulgarian Academy of Sciences took the first place. This situation reveals that the university is more preferred in the context of collaborative work.

Table 1. University Rankings (The Most Cited 10 Universities)

Rank	Organisation	Country	Document	Citations	TLS
1	Winston-Salem State University	USA	4	650	174
2	Bulgarian Academy of Sciences	Bulgaria	3	630	173
3	The University of Hong Kong	China	11	490	131
4	University of Alcalá	Spain	3	423	158
5	University of Vigo	Spain	3	365	114
6	Old Dominion University	USA	4	320	89
7	Shu-Te University	Taiwan	5	280	70
8	Charles III University of Madrid	Spain	4	245	64
9	National Yunlin University of Science and Tech.	Taiwan	3	230	72
10	University of North Texas	USA	3	226	46

When the journals in which the researches included in the study were published are examined, it was seen that the most effective journal in this field is "Computers & Education" (Table 4). This journal was in the first place with nine publications published in the related field and 831 citations received. In addition, it was determined that TLS was higher than other journals. In addition, this journal ranks first in terms of Impact Factor size. It can be said that the articles of the journal containing discussions on the implementation of software and/or hardware focus on the context of use, user/system interface, usability issues and evaluations of user experience, and especially their effects on learning and teaching. In the ranking made according to the number of citations, it was seen that the second journal was "Educational Technology & Society". It was seen that the two publications published in this journal received a total of 584 citations and TLS was 103. It can be said that the related journal includes publications that establish a good bridge between pedagogy and advanced technology applications for an evidence-based and meaningful educational practice. Another important journal that publishes gamification research in education was Computers in Human Behavior. It was seen that the Impact Factor and TLS value of the related journal are high.

Table 2. Journal Rankings (The Most Cited 10 Journals)

Rank	Name of the Journal	Document	Citations	TLS	Cites/Document	IF*
1	Computers & Education	9	831	172	92.33	8.538
2	Educational Technology & Society	2	584	103	292	3.522
3	Computers in Human Behavior	6	547	111	91.16	6.829
4	Journal of Computer Assisted Learning	3	274	39	91.33	3.862
5	International Journal of Emerging Technologies in Learning	15	248	50	16.53	2.587
6	Interactive Learning Environments	8	224	57	28	5.220
7	IEEE Transactions on Learning Technologies	2	221	43	110.5	3.720
8	Simulation & Gaming	1	219	27	219	2.090
9	International Journal of Gaming And Computer-Mediated Simulations	1	203	18	203	0.580
10	JMIR Serious Games	4	190	7	47.5	4.140

**Impact Factor: It is the year 2021 values on the web pages of the journals.*

When the publications conducted were analyzed on a country basis, it was seen that the most cited publications were conducted in the USA (Table 5). The fact that the USA was in the top 10 with three universities in the university ranking given in Table 2 according to the number of citations supports this finding. This rate shows that 30% of all universities were universities in the USA. Although the number of publications in Spain was high, the finding that the number of citations is higher in the USA was remarkable. However,

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Spain's TLS value was higher than other countries. This shows that the scientists in the country were in intense contact with researchers in other countries. In addition, it was noteworthy that Malaysia, Indonesia, China and Portugal, which were among the countries that publish the most in the relevant field, were not among the most cited countries. This result shows that the number of publications and the number of citations do not increase in direct proportion.

Table 3. Country Rankings (First 10 Countries with Most Citations)

Rank	Country	Document	Citations	TLS
1	USA	73	2177	380
2	Spain	125	2070	431
3	Bulgaria	10	645	141
4	China	25	557	124
5	England	35	552	132
6	Germany	34	373	92
7	Taiwan	13	314	68
8	Canada	16	308	49
9	Belgium	13	286	88
10	Brazil	40	286	71

The publication years, the total number of citations, the average number of citations, and the data regarding the citations they received in the last 5 years were examined among the publications that were in the top 10 according to the number of citations (Table 6). The most cited study was Dicheva et al. (2015) is a study titled "Gamification in Education: A Systematic Mapping Study". The journal that published this article is "Educational Technology & Society" presented in Table 4 as the journal with the second most number of citations. The research presents a study of published empirical research on the application of gamification to education. It can be said that the study focuses on articles discussing the effects of using game elements in certain educational contexts with a systematic review (Dicheva et al., 2015). Ranking second in order of citation, Simoes et al. (2013), it was seen that there is a research titled "A social gamification framework for a K-6 learning platform". This study presents the outline and main features of a social gamification framework to be implemented in a K-6 social learning environment (Simoes et al., 2013). The most cited study in the last 5 years is "An empirical study comparing gamification and social networking on e-learning" and De-Macros et al. (2014). Related research examines the effects of both social networks and gamification on students' academic achievement, engagement and attitude in an undergraduate course. The results of the research show that both approaches outperform a traditional e-learning approach, but when it comes to evaluating knowledge, the traditional e-learning approach is better (De-Macros et al., 2014).

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Table 4. Citation Numbers of Articles by Years (The Most Cited 10 Articles)

Rank	Document	Author	Publication Year	Total Citations	Average Citation by Year	Number of Citations in the Past 5 Years				
						2017	2018	2019	2020	2021
1	Gamification in Education: A Systematic Mapping Study	Dicheva, Darina; Dichev, Christo; Agre, Gennady; Angelova, Galia	2015	579	72.38	69	87	113	119	128
2	A social gamification framework for a K-6 learning platform	Simoes, Jorge; Diaz Redondo, Rebeca; Fernandez Vilas, Ana	2013	356	35.6	51	55	57	50	41
3	An empirical study comparing gamification and social networking on e-learning	de-Marcos, Luis; Dominguez, Adrian; Saenz-de-Navarrete, Joseba; Pages, Carmen	2014	279	31	50	44	43	43	34
4	Developing a Theory of Gamified Learning: Linking Serious Games and Gamification of Learning	Landers, Richard N.	2014	219	24.33	19	32	45	36	59
5	The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education	Rice, John W.	2012	203	18.45	2	4	11	27	111
6	A mobile gamification learning system for improving the learning motivation and achievements	Su, C-H.; Cheng, C-H.	2015	200	25	19	33	46	41	33
7	Raising engagement in e-learning through gamification	Muntean, Cristina Ioana	2011	199	16.58	35	31	33	24	27
8	Gamification for Engaging Computer Science Students in Learning Activities: A Case Study	Ibanez, Maria-Blanca; Di-Serio, Angela; Delgado-Kloos, Carlos	2014	185	20.56	28	26	41	34	24
9	Gamification of Cognitive Assessment and Cognitive Training: A Systematic Review of Applications and Efficacy	Lumsden, Jim; Edwards, Elizabeth A.; Lawrence, Natalia S.; Coyle, David; Munafo, Marcus R.	2016	167	23.86	13	29	31	37	44
10	On the effectiveness of game-like and social approaches in learning: Comparing educational gaming, gamification & social networking	de-Marcos, Luis; Garcia-Lopez, Eva; Garcia-Cabot, Antonio	2016	123	17.57	16	20	34	26	16

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Co-authorship: Authors

The "Co-*authorship*" analysis of the publications examined within the scope of the study is given in Figure 3. The network map in the image was accessed from the co-authorship tab according to the authors in the Wosviewer program. Publications with 25 or more co-authorships were not included in the analysis. When authors with at least 1 study were added to the analyses, a total of 1873 authors were found. However, since there was no bibliometric network among all authors, only 29 authors' network maps were created in the resulting image. In the case of co-authoring links between researchers, the TLS value indicates the number of co-*authorship* links a particular researcher has with other researchers. The size of the circles symbolizing the authors in Figure 3 is an indication of the size of the TLS value. In the resulting image, it is seen that there are five clusters, namely red, green, yellow, blue and purple. Among these clusters, red, green and yellow colored clusters are clearly seen. It can be said that Seiji Isotani (TLS=24) collaborated with researchers from different clusters the most with seven publications in the red cluster (f=9), which is the most prominent cluster. It has been determined that the related author has conducted joint research with many authors in England, Canada, Japan and Brazil and received a total of 195 citations from these publications. Another prominent author according to the co-authorship analysis was Isabela Gasparini (TLS=17) from the yellow clusterIt has been determined that the related author was in collaboration with researchers in Brazil and England. It was seen that the author's study titled "User-Centered Gamification for E-Learning Systems: A Quantitative and Qualitative Analysis of its Application" was the most cited (Cited=56) research. Another leading researcher in the co-authorship analysis was identified as Machiel Armando Toda from the green cluster. It can be said that the researcher has worked effectively with leading authors (S. Isotani, I. Gsparini) in other clusters.

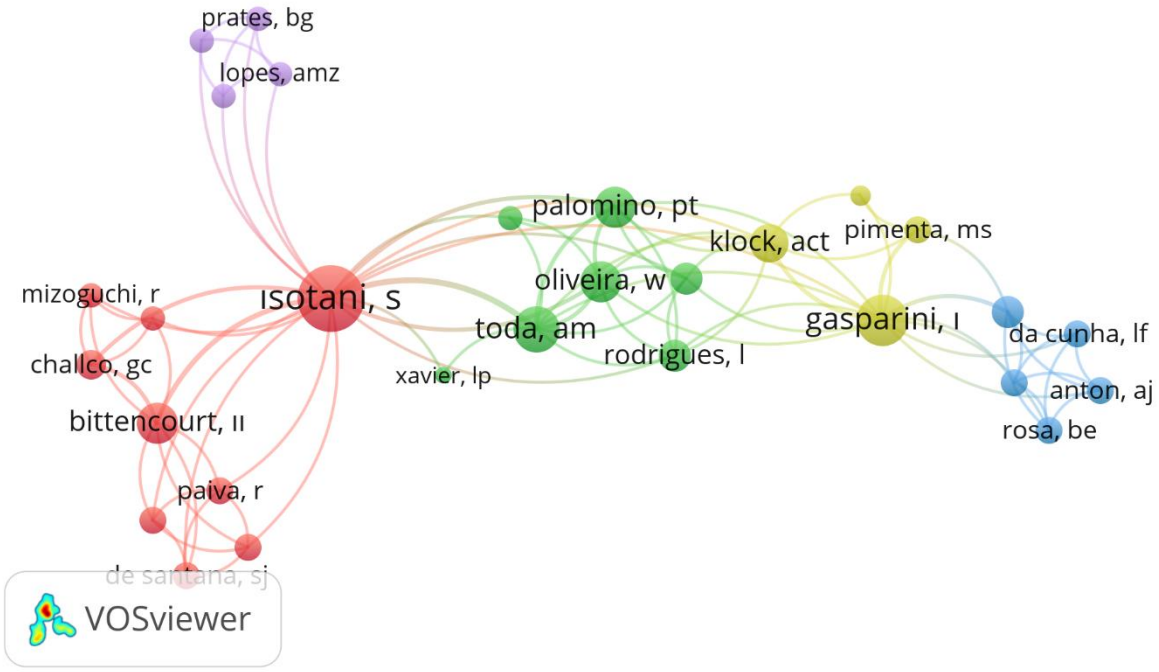

Figure 2. Co-authorship Network Map

Co-occurrence: Keywords

The relational network map created according to the keywords used by the authors in the publications examined was shown in Figure 4. ccording to the co-occurrence analysis conducted with 1418 keywords that met the criteria for use in at least five publications. We excluded the keywords "gamification", "gamif", "learning", "education", "training", "instruction" and "teaching" because they were used in the query. It was seen that a total of 1418 keywords were used, but only 56 of these keywords have a relational network map. In the resulting image, 9 clusters were formed. Among these clusters, the red, purple and blue clusters were the most prominent. The words used in the blue cluster (f=8) were more specific than the other clusters due to their TLS and frequency of use. In particular, the word "motivation" stands out in terms of common usage frequency (TLS=178). In this context, it can be said that motivation is the most studied variable in research on gamification in education. In the purple cluster (f=7), the words "e-learning", "student engagement" and "learning analytics" stand out. It can be said that the words in this cluster focus on the contribution of

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gamification to learning. In the red cluster (f=10), it was seen that the most used words were "higher education", "game-based learning" and "framework".

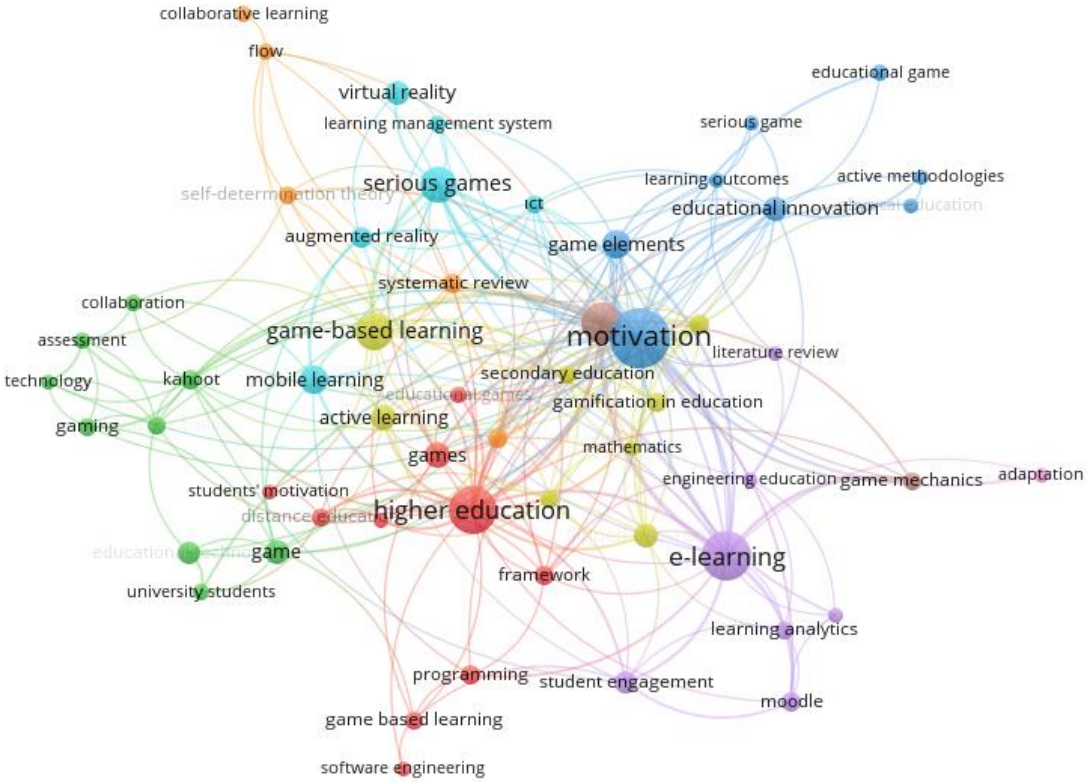

Figure 3. The Network Map of Most Frequently Used Keywords

Citation: Documents

The temperature diagram for the countries with the most publications among the publications examined within the scope of the research was given in Figure 5. All publications were included in our research, regardless of the number of citations. In the next step, it was entered as "minimum number of citations of a country / minimum citation number of countries=0". In this way, data for a total of 81 countries emerged. However, a relational network map has emerged among only 74 countries from these data. In the resulting image, 12 clusters were formed. The gradual change of the colors symbolizing the publications in the figure on the blue-green-yellow-red scale was an indication of the large number of publications. It was seen that countries such as USA (N=73), Spain (N=125) Brazil (N=40), England (N=35), Malaysia (N=32) and Indonesia (N=25) were located in the region that was most prominent in the image. . If a comparison was made in terms of the most cited countries (Table 5), it was seen that England, USA and Spain were in the top ten. It was a striking result that although the number of publications in Malaysia and Indonesia was high, it was not among the top ten countries in terms of the number of citations. In addition, it was determined that the TLS of countries such as Spain (TLS= 431), USA (TLS= 380) and Bulgaria (TLS= 141) was high. However, it can be said that Bulgaria has a significant number of citations despite the few publications (N=10). This situation can be considered as an indication of the strong international cooperation of researchers in the relevant country (TLS=141).

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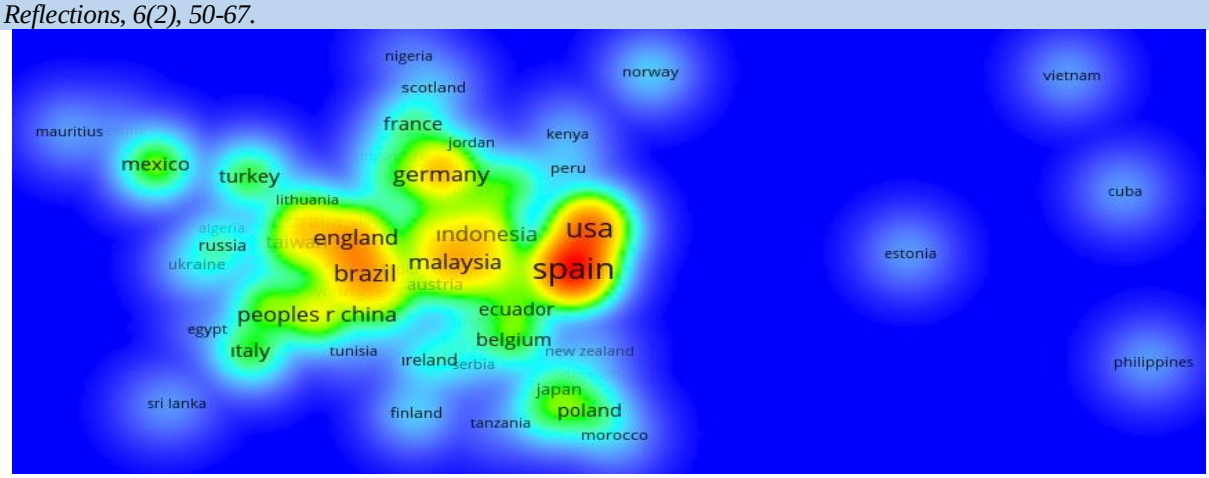

Figure 4. Density Visualization of the Most Cited Publications

Citation: Authors

The most cited authors from the publications reviewed in this study and the relational network map they created were shown in Figure 6. All researchers were included in our research, regardless of the number of citations. In the next step, it was entered as "minimum number of documents of an author=2". Publications with 25 or more authors were not included in this analysis. As a result, data belonging to 181 authors emerged. However, it was seen that a relational network map was formed among only 146 authors from these data. In the resulting image, 13 clusters were formed. The size of the circles symbolizing the authors in Figure 6 was an indication of the TLS. Green, yellow, blue and red colored clusters were clearly seen from these clusters. Luis De-Marcos (N=423) was determined to be the leading authors according to the number of citations in the green cluster (f=31), which was the most prominent cluster. It can be said that the related author was collaborating with many authors (TLS=108). Luis De-Marcos' research titled "An empirical study comparing gamification and social networking on e-learning" seems to be the most cited. In another cluster, the yellow cluster (f=15), Christo Dichev was the prominent author. When the TLS of the related author was examined (TLS=100), it was seen that he was in cooperation with different researchers. This situation makes us think that the researcher gets many citations (Cited = 650). In another cluster, the turquoise cluster (f=12), Khe Foon was among the leading authors in terms of TLS (86). The findings show that higher TLS values of researchers cause more citations. In addition, since the authors at the extreme points in the image only have a citation relationship with some authors in the neighboring cluster, it can be said that they were located in weak regions in terms of connection strengths at the extreme points.

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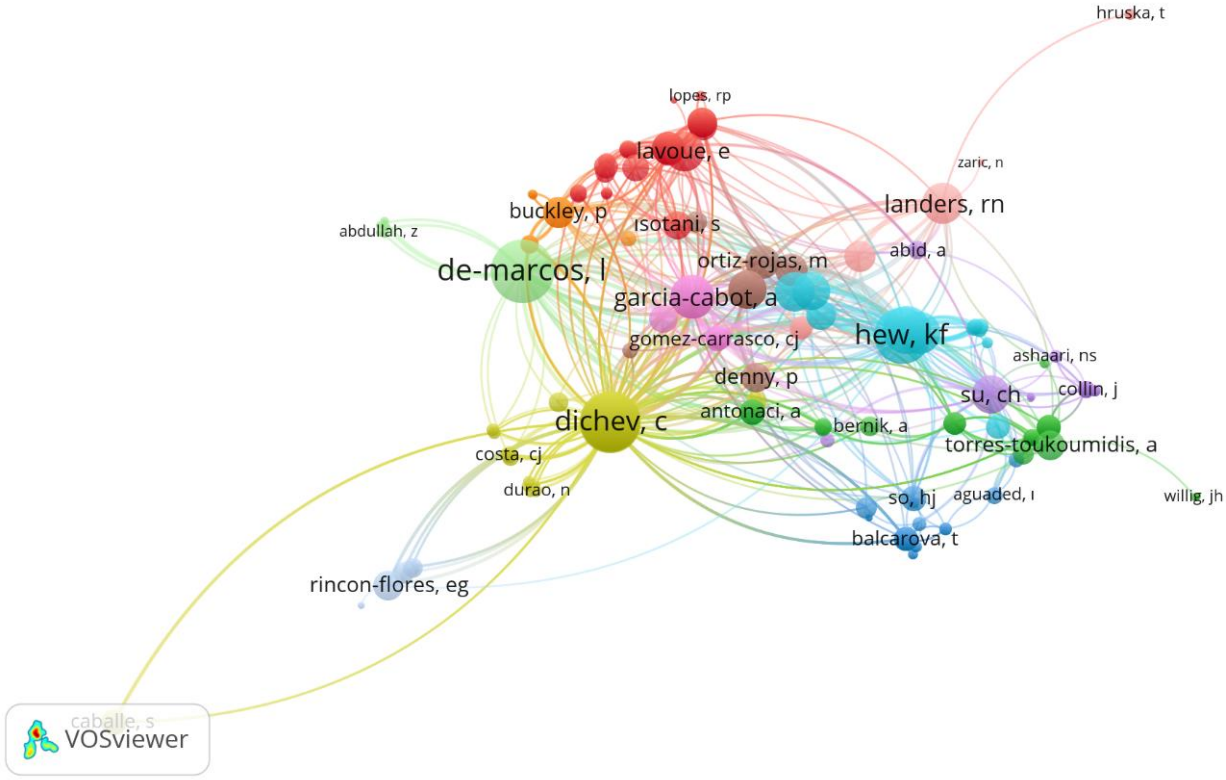

Figure 5: The Network Map of the Most Cited Authors

Citation: Countries

The most cited countries from the reviewed publications and the relational network map they created were shown in Figure 7. Countries with at least 1 article were included in the analysis, while publications with 25 or more authors were not included in the analysis. In this way, data for a total of 81 countries emerged. However, from these data, it was seen that a relational network map was formed between only 74 countries. In the resulting image, 12 clusters were formed. The clusters formed by the common citation networks of the countries on the map are colored according to the years. When the clusters are examined, Spain, the USA and the UK are the leading countries in terms of TLS. It can be said that the publications conducted in these countries attract global attention. However, recently, Turkey (TLS=79) and Mexico (TLS=70) seem to be the most cited countries. It was noteworthy that these countries have high TLS values.

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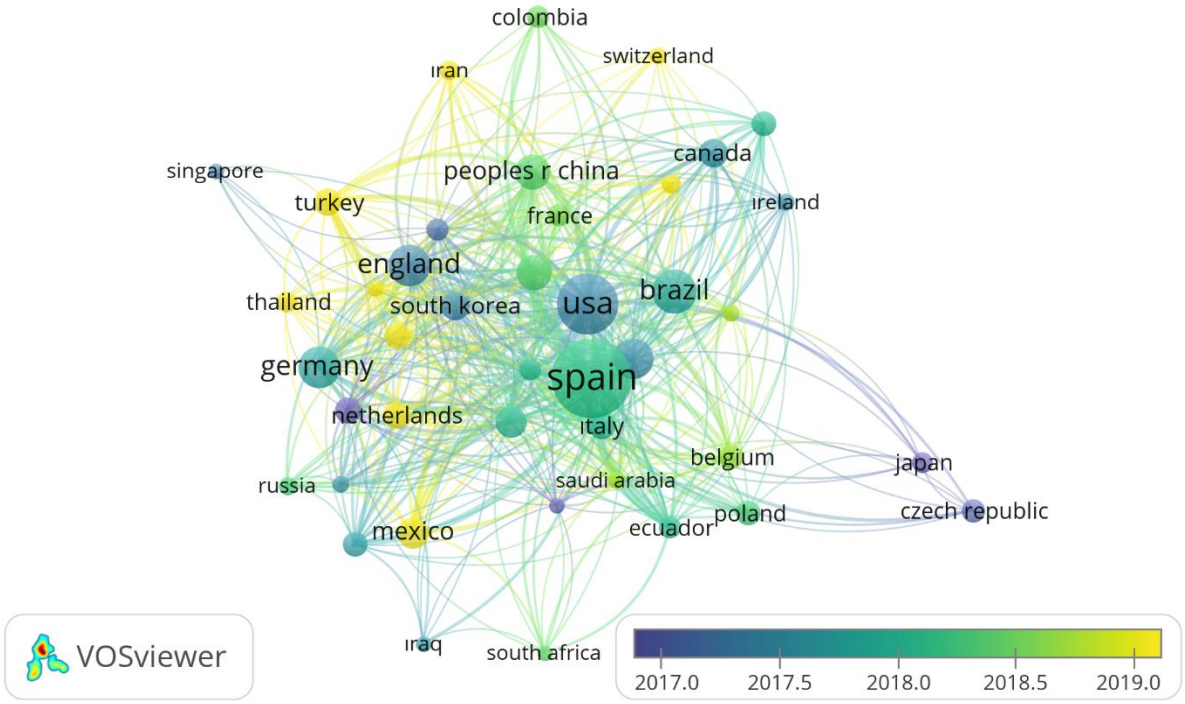

Figure 7. The Network Map of the Most Cited Countries

Co-citation: Cited Authors

In bibliographic mapping analysis, which reveals the relationship based on the bibliography of the publications, two different publications are cited in a single source. A map of all authors with at least two publications was given in Figure 8. In the analysis, "minimum number of citation of a document/minimum number of publications by the author: 3" was entered. The reason for this was that the clusters formed can be displayed more clearly. In this way, data belonging to a total of 38 authors emerged. When Figure 8 is examined, it was seen that six different meaningful clusters have emerged. When the bibliographic mapping was examined, it was seen that the largest cluster was red (item=12). Accordingly, it can be said that the researchers in the red cluster (Dichev, C., Hew, K. F., Dicheva, D.) conducted similar publications and referred to similar publications. Researchers in another large cluster, the green cluster (Sanmugam, M; Abdullah, Z; Mohamed, H; Aris, B; Zaid, NM; Suhadi, SM) seem to be working together in Indonesia. On the other hand, when the researchers (Khaleel, F.L., Ashaari, N.S., Ismail, A.) in the turquoise cluster, which was the smallest cluster, were examined, it is noteworthy that they are from Malaysia.

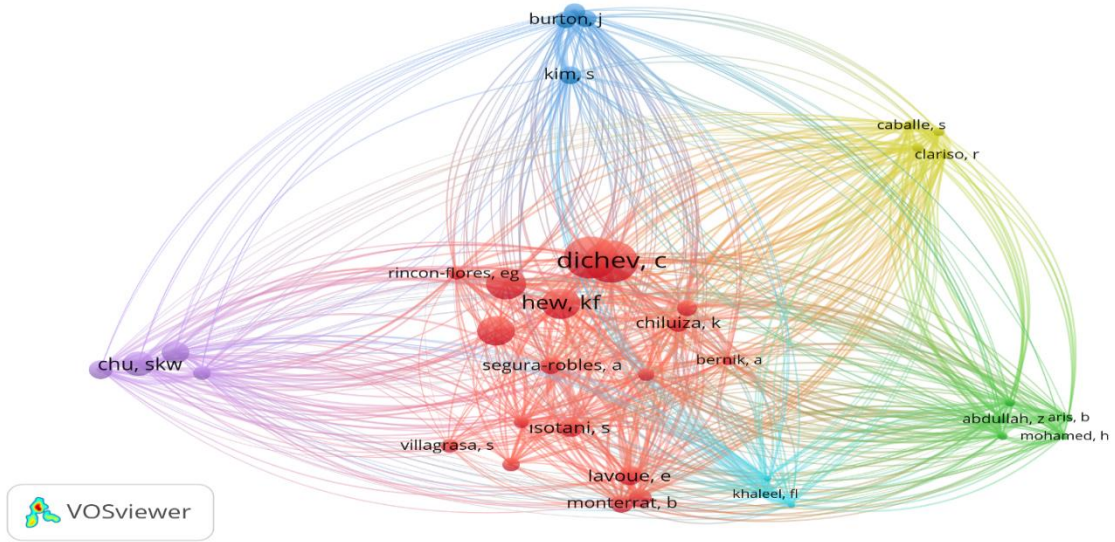

Figure 8. The Network Map of the Most Co-cited Authors

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Discussion

It can be said that there is an increasing interest in gamification in education (Brunborg et al., 2014). In addition, recent publications draw attention to the importance of gamification in education (Koivisto & Hamari, 2019). The present research is designed to review the orientations and trends of research on the application of gamification to education. Regarding the limitations of the present review, the selection criteria only include publications that explicitly examine the effects of applying game elements in an educational context. Using bibliometric analysis, the study analyzed 1170 publications published in the WoS database on gamification in education. The result of the research showed that the most cited authors in the related field were Dichev and Dicheva, who worked at Winston-Salem State University in the USA. In addition, when the ratio of the number of citations to the number of publications was compared, it was determined that the number of publications and the number of citations did not show a direct proportion. Hirsch (2005) states that the total number of publications used, the total number of citations, and the number of citations per publication are important when evaluating the outputs of researchers. Accordingly, although K. F. Hew's citations were high, it was determined that the number of citations per publication was quite low. The fact that the number of citations per the number of publications is low can be interpreted as the fact that the relevant publications do not have a great impact on the literature. The results of the research show that publications in the field of gamification in education are published in journals focusing on technology areas. It can be said that especially these journals have increased their influence in the last decades. One reason for this is the frequent use of technology in education and training settings. Yaşar and Alkan (2019) state that almost all digital native students expect the use of new technologies in educational environments. As a result, the importance attributed to the use of digital games is increasing, especially in developed countries. This may result in the widespread use of technology-supported games in education and training. Therefore, it is seen that the integration of gamification with technology in education has resulted in publications in education and technology journals. It was determined that the most publications in the related field were made in Spain, USA and Brazil. In addition, it was determined that Spain and the USA had high citation counts, while Brazil had dramatically less citations compared to the number of publications. The number of citations is a criterion used to estimate the impact or importance of an article (Yank & Lee, 2013). Moreover, it is known that citations are used in the academic community when being accepted or promoted to a job (Borgman & Furner, 2002). In this context, high citations can be seen as an important criterion. Despite the high number of publications in Brazil, the low number of citations can be considered as a finding that the effect of the publications conducted is weak. In addition, the majority of the studies published in Brazil were published in Brazilian journals, which can be seen as another reason for the low number of citations. In addition, it is seen that the country with the highest number of citations in the field of gamification in education is the USA. The fact that the publications in the literature state that the USA is among the countries with the most research on gamification in education strengthens the results of the current research (Ortiz-Rojas et al., 2017). Moreover, Moreover, the fact that the first Gamification summit was held in the US state of San Francisco can be seen as another reason for doing more work in this area in the USA. Furthermore, due to cultural differences in each country, learners' attitudes and expectations towards learning through gamification may be different (Subhash & Cudney, 2018). This situation can be seen as a reason why different publications are carried out in different countries. In addition, the results of the citation analysis of the countries by years show that Turkey and Malaysia are the countries that received the most citations in recent years. This situation can be interpreted as the fact that they have succeeded in attracting the attention of other researchers by conducting current and effective publications in the relevant countries. The co-occurrence analysis of keywords, which was another finding of the research, showed that the most important concepts examined in the articles in the field of gamified education were gamification, motivation, game elements and educational innovation. The results of a study have been determined that motivation, game elements and educational innovation are frequently used in publications related to gamification in education (Subhash & Cudney, 2018). In fact, motivation, learning achievement, interaction, competition and innovation are some effects of such interventions. Gamified tests at the beginning and end of each class increase students' mastery of course content and participation during classroom activities, as well as improve their cognitive, emotional, and behavioral engagement (Zainuddin et al., 2020). Another result of the research was that the network map of the most commonly cited authors has a dispersed structure. The fact that the map is less dispersed and the circles are close together indicates that researchers in related clusters are more likely to cite similar publications. In addition, the fact that researchers were in the same clusters and close to each other is interpreted as doing research on similar subjects (Van Eck & Waltman, 2020). In this direction, it can be said that leading authors have done similar publications on gamification in education. Apart from this, it can be said that a group of Asian scientists are working on different subjects in

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the related field. Current research provides the most relevant theoretical contributions from an innovative technique in the field of bibliometric research. In addition, it can be said that the results of the study are not only aimed at the academic community, but also addressed to educators and politicians in order to identify trends in research on gamification in education, design effective policy tools and ultimately improve education and training environments.

Limitations of study

Like any other academic endeavor, this study has its own shortcomings. The first limitation was uncovered in line with the data obtained from the WoS database of analyzes of the current research. This has resulted in the inclusion of books, book chapters, papers, articles and theses published on gamification in education in other databases. Therefore, the current study did not examine all the literature on gamification in education. However, it can be said that two factors in the present study alleviate this limitation. The database first examined in this study is the largest database compiled in any research review on gamification in education to date. Secondly, it is the ability of the common citation analysis in the Vosviewer program to capture studies outside the database used in the research. It is difficult to estimate to what extent the findings of the present study are generalized when considering all databases. Another limitation is that bibliometric analysis methods focus on a quantitative and descriptive overview of the literature rather than providing a qualitative summary of research findings. Therefore, it only serves as a preliminary guideline for new research on the subject. Therefore, unlike traditional meta-analyses, it does not address literature-related issues such as effect sizes and publication bias. After readers have identified the relevant information in this article, it is recommended to explore the main findings of the literature.

Referances

(* shows the publications included in the bibliometric analysis.)

Behl, A., Jayawardena, N., Pereira, V., Islam, N., Del Giudice, M., & Choudrie, J. (2022). Gamification and e-learning for young learners: A systematic literature review, bibliometric analysis, and future research agenda. *Technological Forecasting and Social Change*, *176*, 121445.

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Klock, A. C. T., Ogawa, A. N., Gasparini, I., & Pimenta, M. S. (2018, April). Does gamification matter? A systematic mapping about the evaluation of gamification in educational environments. In Proceedings of the 33rd Annual ACM Symposium on Applied Computing (pp. 2006-2012).

Knutas, A., Ikonen, J., Maggiorini, D., Ripamonti, L., & Porras, J. (2014). Creating software engineering student interaction profiles for discovering gamification approaches to improve collaboration. In *Proceedings of the 15th international conference on computer systems and technologies* (pp. 378–385). New York, NY: ACM.

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