The 6th International Conference on Economics and Social Sciences
**Geopolitical Perspectives and Technological Challenges
for Sustainable Growth in the 21st Century**
June 15-16, 2023
Bucharest University of Economic Studies, Romania

Kahoot! A Bibliometric Analysis Using Web of Science Data

Tudorel ANDREI[1], Andreea MIRICĂ[2], Ionela-Roxana PETCU[3*]

Abstract

Gamification has become widely spread in classrooms at all educational levels during the COVID-19 pandemic. Through integrating game elements (such as points, chronometers) into teaching, educators have enhanced students' experience both during online as well as in physical classes. Integrating easy to use gamification platforms such as Kahoot! has become increasingly popular during higher education courses, as they made learning more fun, engaging, and interactive for the new generation of students, emphasising a global cultural phenomenon. There is an increasing body of research in this area. The current paper focuses on Kahoot!, one of the most popular gamification platforms. The main objective of the research is to perform a meta-analysis of the scientific papers related to this gamification platform. Data from Web of Science was retrieved and a database comprising of all Clarivate research papers on Kahoot topic was used. To reveal the main topics covered by the papers, the word cloud and graph-collocation techniques were used. The obtained results answer the research questions on how the number of research papers on Kahoot! evolve over the years in terms of bibliometric parameters such as number of authors, pages, and citations and what are the covered topics. The outputs indicate that the highest number of research papers concerning Kahoot was recorded in 2019 and the share of research papers with three or more authors in the total figures increased during the pandemic. The analysis indicates that these research papers are oriented towards the usage of Kahoot as a platform rather than on technicalities.

Keywords: Kahoot, gamification, learning.

JEL Classification: I2.

---

[1] Bucharest University of Economic Studies, Bucharest, Romania, andreitudorel@yahoo.com.
[2] Bucharest University of Economic Studies, Bucharest, Romania, miricaandreea89@gmail.com.
[3] Bucharest University of Economic Studies, Bucharest, Romania, glavan.roxana10@gmail.com.
* Corresponding author.

1. Introduction

Switching from face-to-face classes to online teaching in the beginning of the COVID-19 pandemic led to a high level of uncertainty among students in terms of the quality of teaching (Buzatu et al., 2020). Students often pointed out several issues of the online teaching process: inadequate teaching materials, lack of quality control, lack of engaging student-centred learning activities (Zeshan, 2021).

The scientific literature points out several strategies for enhancing students' experience during online classes. For example, Mishra et al. (2020) states that providing students with a variety of activities is essential in order to minimise monotony. Mahmood (2021) concludes that interactivity is a key element for a successful online class. Flores et al. (2022) stresses the impact of teachers' choice of teaching instruments on the positive adaptation of students. Moreover, literature suggests that teaching strategies and materials should be further integrated in classes in the COVID-19 aftermath (see, for example, Turnbull et al., 2021).

2. Problem Statement

Gamification is an excellent tool for online teaching (Nieto-Escamez, Roldán-Tapia, 2021) ensuring interactivity and providing an engaging experience for students. There is a vast scientific literature covering this field.

However, bibliometric studies are rather scarce and generally focus on broad issues of the topic or are limited to certain subareas or time frames. For example, Encarnação et al. (2021) used the keywords "gamification" and "motivation" to retrieve papers, narrowing the search to the business sub-area. Kamarrudin et al. (2022) used the "active engagement" and "science education" queries to retrieve papers between 2016 and 2020.

Miranda and Tolentino (2023) performed a bibliometric analysis on how Information Communication Technology is applied in health education. Other papers focus only on gamification, game-based learning, serious games, or educational games (see Guerrero-Alcedo et al., 2022; Irwanto et al., 2023; Aragonez et al., 2020; Zeng, Shang, 2018; Reuter et al., 2020; Hebebci, Alan, 2022; Nadi-Ravandi, Batooli, 2022; Chugh, Turnbull, 2023).

Concerning the databases used to retrieve papers for the bibliometric analysis, a variety of approaches can be observed. Many studies use Scopus (Encarnação et al., 2021; Guerrero-Alcedo et al., 2022; Irwanto et al., 2023; Kamarrudin et al., 2022; Akbar and Rajulain, 2022). Some of the studies use Web of Science: the Social Sciences Citation Index sub-database (Zeng, Shang, 2018); the education educational research, education scientific disciplines, and education special categories (Hebebci and Alan, 2022); the entire database (Nadi-Ravandi, Batooli, 2022; Aragonez et al., 2020; Chugh, Turnbull, 2023). Few studies use Web of Science as well as Scopus (Reuter et al., 2020) or other databases such as "Dimention.ai" (Assidik, 2022).

The present study aims to provide value added to the existing literature in two ways. First, it focuses only on Kahoot! as a gamification tool, which to our knowledge, no such bibliometric analysis has been performed. Second, it provides a bibliometric analysis as well as a topic analysis on papers from all databases in Web of Science without a time frame or domain restriction.

3. Research Questions

The paper aims to answer the following research questions: Q1. How did the number of research papers on Kahoot! evolve over the years? Are there any patterns concerning the number of authors, the number of pages, or the number of citations? Q2. What topics do the papers on Kahoot! cover? Are there any interesting connections between these topics?

4. Research Methods

For the purpose of this paper, data from Web of Science was used. In order to extract the data, a research query on the keyword "kahoot" was conducted for all Web of Science databases. Data was extracted on March 13th 2023 and comprises of records on 481 documents.

In order to answer the first research question, a graphical analysis was conducted.

Furthermore, two techniques are used to address the second research question. First, a wordcloud based on the abstracts of all 481 papers was performed in order to display the most frequently used words. This technique provides insights of the topics covered by the papers (see, for example, Mirică, Petcu, 2022; Scwacha, 2022). Second, a graph-collocation for the word "kahoot" using Lancsbox v.4.5 was constructed (Brezina et al., 2018). The graph provides powerful insights on how the word "kahoot" collocates with other words in the text, suggesting possible research topics. In order to display collocations, the following parameters were set: word span = 5 to the right and left; the minimum frequency of the collocation occurring = 50.

Limitations of the study derive from the data made available by Clarivate as the dataset was constructed based on the data extracted on 13th of March 2023 and comprises of records on 481 documents. Such an aspect is of importance as Clarivate indexes with delay in WOS the published papers or may omit some of the already published ones. As such, the dataset does not reflect the exact number of published papers on Kahoot topic-indexed WOS, more specifically for the year 2022 as only reflects the status at the time of the data extraction. Further limits are the ones introduced through the usage of Lancsbox v.4.5 and word-cloud package. Mitigation of the later limits may be done through the usage of newer releases of both the Lancsbox and word-cloud package. The first limitation is intrinsic and accepted as is, as a consequence of using products owned by Clarivate.

5. Findings

Figures 1, 2 and 3 provide answers to the first research question. The oldest paper in the database was published in 2015 while the newest dates from 2023. However, due to the fact that there was only one paper registered, 2023 was not included in the graphical analysis.

Figure 1 displays the number of papers by the number of authors and publication years. The highest number of papers was recorded in 2019. In addition, the number of papers published during the pandemic years was quite high. Moreover, the share of papers with 3 or more authors in the total number of papers increased. This is not surprising, as online classes based on gamification were perceived as fun and engaging (Nieto-Escamez, Roldán-Tapia, 2021), thus sparking academic dialogue.

Figure 1. Number of papers by number of authors and publication year
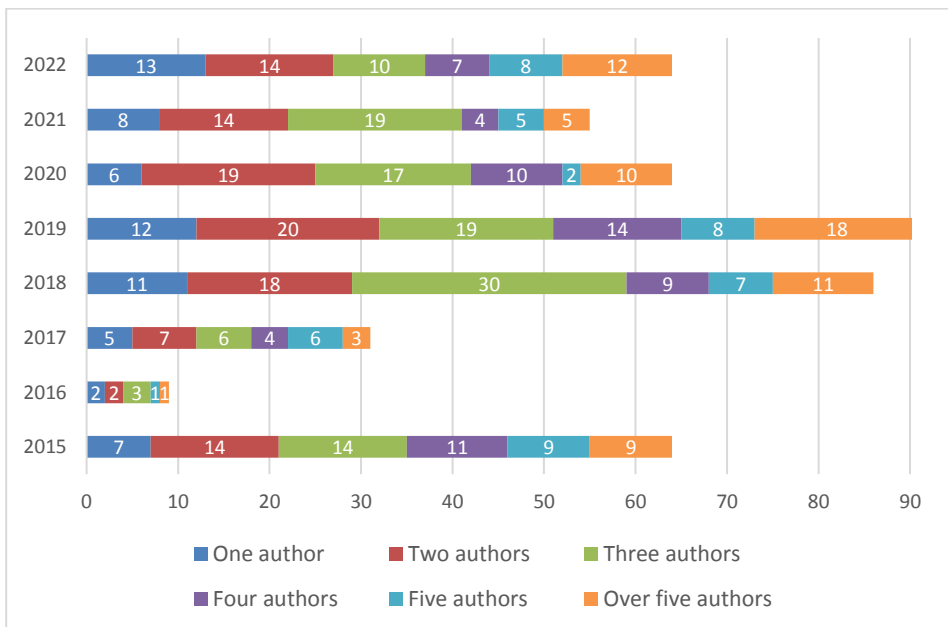
Source: Designed by the authors based on Web of Science data.

Figure 2 shows the share of papers by the number of pages during the analysed period. Between 2015 and 2019 papers with 1 to 10 pages were predominant. Since 2020, the length of the papers increased, suggesting a more in-depth analysis of the topic. Several innovations introduced by the platform during the pandemic years (Hanoa, 2022) may have contributed to the growth of the body of literature.

Figure 2. Share of papers by number of pages between 2015 and 2022
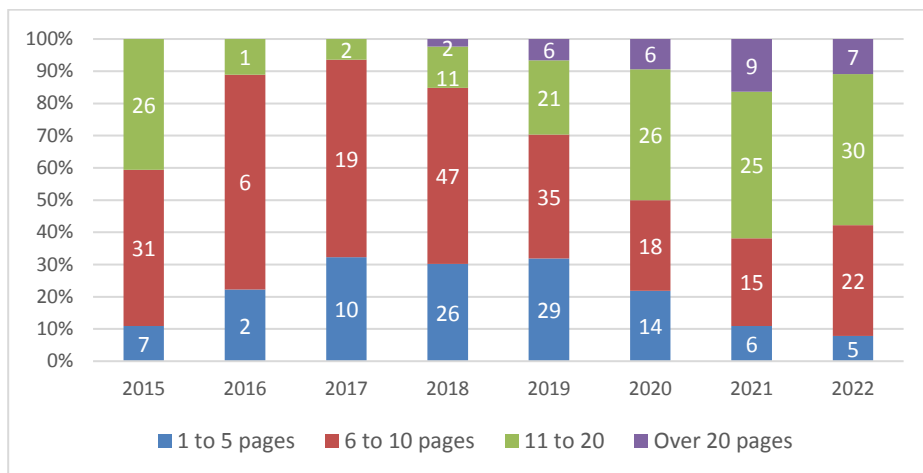
Source: Designed by the authors based on Web of Science data.

Figure 3 displays the number of papers by the year of publication and the number of citations. While most papers do not have any citations, the number of cited papers is increasing. This suggests that the topic is just beginning to be in focus.

Figure 3. Number of papers by year of publication and number of citations

Source: Designed by the authors based on Web of Science data.

Figures 4 and 5 provide answers to the second research questions. As presented in Figure 4, the words with the highest frequencies are students/student, learning,

study, tool/tools, gamification/game, kahoot. Furthermore, we also see words such as knowledge, teaching, education, research, classroom, motivation, using, and teachers. As well with red colour are presented words such as online, questions, engagement, evaluation, activities, platform, and positive. Based on results of the word-cloud analysis, in terms of the usage of "kahoot" in the dataset with abstracts of research papers Web of Science, interesting connections are obtained. Motivation and engagement are an interesting confirmation of Kahoot's utility, while questions, evaluation, activities in online education classrooms present the positive reception among students.

Figure 4. Word-cloud of the analysed corpus

Source: Designed by the authors based on Web of Science data.

Figure 5 presents collocation graph of "Kahoot" within the analysed corpus for a collocation frequency of 50 and a 5-word span. Collocation graph displays three dimensions: strength of collocation, frequency collocation and position collocates. The strength of collocation is indicated by length of the line between the node and collocates, therefore the closer the collocate is to the node the stronger the strength of the association between the two. The frequency is indicated by the colour intensity of the collocate, the darker the shade of the colour the more frequent the collocation. The Position of the collocates around the node reflects the position of the collocates in the text.

Based on the stated information on collocation graphs, "connection words" such "the", "and", "a", "of", "to" are excluded in terms of interpretation as they weigh more strength in terms of collocation but reveal less meaning for the second question. Of relevance in order of strength magnitude are the links between word "kahoot" and its obtained collocates "students", "platform", "learning", "using", "game-based" and "online". In terms of descending frequency of the collocation are the

links between "kahoot" node and "students", "learning", "using", "game-based", "platform", "online". Reflecting the collocation position, the collocates "students", "online", "game-based", "were", "using", and "learning" are situated to the left of the node "kahoot", while on the right side the collocates "platform", "tool", "was", "used" are obtained.

Results presented in Figure 5 show that the collocations between the word "kahoot" and the words "students", "learning", "platform", "tool" and "game-based" have meaning in terms of strength and frequency, thus suggesting possible research topics and that Kahoot is seen in the scientific community as a useful platform for students in online environment set-up for game-based learning.

**Figure 5. Collocates of "Kahoot" within the analysed corpus
for a collocation frequency of 50 and a 5 words span**
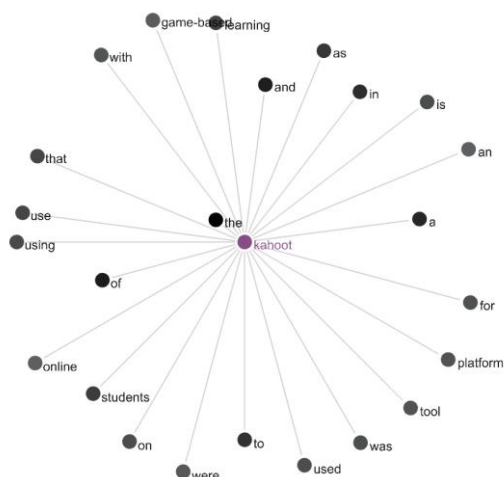
Source: Designed by the authors using Lancsbox 4.5 based on Web of Science data.

These findings suggest that the research papers are focused on Kahoot as a tool to enhance learning, create game-based classes, and student-centered environments. Thus, the research papers are oriented toward the uses of the platform rather than on technicalities.

6. Conclusions

The research paper contributes to the field and offers a meta-analysis of the scientific papers concerning Kahoot! gamification platform. Data from Web of Science was employed in our study with a database of all research papers on Kahoot! from Clarivate.

Our results indicate that the highest number of papers concerning this topic was recorded in 2019 and the share of papers with 3 or more authors in the total figures increased during the pandemic years. A more in-depth analysis of the topic is pointed

out by the increasing length of the papers since 2020 and also by the increase in citations. This finding is in line with the recent innovations brought to the platform.

Moreover, to reveal the main topics covered by the papers on this topic, the word cloud and graph-collocation techniques are used, revealing that Kahoot! is properly addressing student-centered environments. Such findings suggest that existing Clarivate published papers on this topic are targeting to more extent the game-based learning approaches and integrate different engagement methods of teaching to improve completion rate.

Innovative technology has the benefit of improving the experience both during online as well as in physical classes. In this respect, integrating gamification platforms such as Kahoot! makes learning more fun, increase engagement and interaction as the new generation of students tend to use more often digital instruments in contrast to traditional ones. Contributions to education are linked to 1st and 4th of the Sustainable Development Goals (UN, 2023; Biermann et al., 2017). Such implications have a positive impact through reducing school drop-out rates and having better student yearly outcomes as a result of their increased engagement.

Two limitations of the study are identified, the first being intrinsic and accepted as is due to using products owned by Clarivate and the second sourcing from employing Lancsbox v.4.5 and using the word-cloud R package. The first limitation involves that the dataset does not reflect the exact number of published papers on Kahoot topic indexed WOS, more specifically for the year 2022 it reflects the status at the time of the data extraction, as Clarivate indexes with delay in Web of Science the published papers. The dataset may be extracted once more in two to three years, having a more refined image with the exiting figures for Web of Science indexed papers in Clarivate. Mitigation of the second type of limits closely related to the visualisations may be done through the usage of newer releases of both Lancsbox and word-cloud package.

References

[1] Akbar, M.R., Rajulain, M. (2022). Journal Mapping and Research Opportunities on Digital Learning Themes, In *National Seminar of PBI* (English Language Education), 277-286.

[2] Aragonez, T., Saur-Amaral, I., Gouveia, M. (2021). Game-based learning in higher education: A systematic literature review. In *EDULEARN21 Proceedings IATED*, 1849-1856.

[3] Assidik, G.K., Dianastiti, F.E., Vinansih, S.T., Kustanti, E.W. (2022). From ICT-Based Learning Media to Gamification Optimalization: Learning Media Research Projection Based on Bibliometric Analysis. In *7th Progressive and Fun Education International Conference (PROFUNEDU 2022)*, 21-34, Atlantis Press.

[4] Biermann, F., Kanie, Norichika, K., Rakhyun E. (2017). Global governance by goal-setting: the novel approach of the UN Sustainable Development Goals. In *Current Opinion in Environmental Sustainability*, 26, 26-31.

[5] Brezina, V., Timperley, M., McEnery, T. (2018). #LancsBox v. 4.5 [software], available at: http://corpora.lancs.ac.uk/lancsbox.

[6] Buzatu, A.R., Cojoc, C., Cotovici, E., Spirache, M.C., Trandafir, R., Paun, M. (2020). Students' perception of online education in the COVID-19 pandemic framework, *Romanian Statistical Review*, *3*, 3-14.

[7] Chugh, R., Turnbull, D. (2023). Gamification in education: A citation network analysis using CitNetExplorer, *Contemporary Educational Technology*, 15(2), ep405.

[8] Encarnação, R., Reuter, J., Ferreira Dias, M., Amorim, M. (2021, October). Gamification as a driver of motivation in the organizations: A Bibliometric Literature Review. In *Ninth International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'21)*, 167-172.

[9] Flores, M.A., Barros, A., Simão, A.M.V., Pereira, D., Flores, P., Fernandes, E., Costa, L., Ferreira, P.C. (2022). Portuguese higher education students' adaptation to online teaching and learning in times of the COVID-19 pandemic: personal and contextual factors, *Higher Education*, *83*(6), 1389-1408.

[10] Guerrero-Alcedo, J.M., Espina-Romero, L.C., Nava-Chirinos, Á.A. (2022). Gamification in the University Context: Bibliometric Review in Scopus (2012-2022). *International Journal of Learning, Teaching and Educational Research*, 21(5), 309-325.

[11] Hanoa, E. (2022). Innovation, platform growth and a global brand delivered a successful Q2 for Kahoot! https://kahoot.com/blog/2022/08/11/kahoot-q2-2022/ accessed Mach 17th 2023.

[12] Hebebci, M.T., Alan, S. (2021). Gamification in Education: An Overview of the Literature, *Current Studies in Social Sciences 2021*, 174-194.

[13] Irwanto, I., Wahyudiati, D., Saputro, A.D., Laksana, S.D. (2023). Research Trends and Applications of Gamification in Higher Education: A Bibliometric Analysis Spanning 2013-2022, *International Journal of Emerging Technologies in Learning*, 18.5.

[14] Kamarrudin, H., Talib, O., Zamin, A.A.M. (2022). Examining the trend of research on active engagement in science education: Bibliometric analysis, *Journal of Turkish Science Education*, 19(3).

[15] Mahmood, S. (2021). Instructional strategies for online teaching in COVID-19 pandemic, *Human behavior and emerging technologies*, 3(1), 199-203.

[16] Miranda, J.P.P., Tolentino, J.C.G. (2023). Bibliometric and Network Analyses of Information and Communications Technology Utilization in Health Education, In *Handbook of Research on Instructional Technologies in Health Education and Allied Disciplines*, 55-79, IGI Global.

[17] Mirică, A., Petcu, I.R. (2022). Papers About COVID-19, In Romanian Social Sciences ISI Journals – What Are They About And What Is Their Impact?, *Annals of the „Constantin Brâncuşi" University of Târgu Jiu*, Economy Series, 3, 103-110.

[18] Mishra, L., Gupta, T., Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic, *International Journal of Educational Research Open*, *1*, 100012.

[19] Nadi-Ravandi, S., Batooli, Z. (2022). Gamification in education: A scientometric, content and co-occurrence analysis of systematic review and meta-analysis articles, *Education and Information Technologies*, 27(7), 10207-10238.

[20] Nieto-Escamez, F.A., Roldán-Tapia, M.D. (2021). Gamification as Online Teaching Strategy During COVID-19: A Mini-Review, *Frontiers in Psychology*, 12, 648552.

[21] Reuter, J., Dias, M.F., Madaleno, M., Amorim, A., Vitória, A. (2020). Game based learning on transversal skills development: An applied state of the art. In *EDULEARN20 Proceedings IATED*, 6010-6019.

[22] Turnbull, D., Chugh, R., Luck, J. (2021). Transitioning to E-Learning during the COVID-19 pandemic: How have Higher Education Institutions responded to the challenge?, *Education and Information Technologies*, 26(5), 6401-6419.

[23] Unite Nations (UN) (2023). The 17 Goals. Sustainable Development Goals, https://sdgs.un.org/goals/, accessed April 29.

[24] Zeng, J., Shang, J. (2018). A review of empirical studies on educational games: 2013-2017, In *26 International Conference on Computers in Education*, 533-542.

[25] Zeshan, A. (2021). Business Students Experiences about Online Learning During COVID-19: Problems and Opportunities, *Romanian Statistical Review*, (2).