Use Of the Quizizz Tool by Primary School Teachers: A Review of The Literature in Scopus from 2017-2023

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Abstracts: The objective of this study was the analysis and quantification of the scientific literature by means of metrics in relation to the research consulted on the use of the Quizizz tool by primary education teachers during the period 2017-2023. Thus, the search was carried out through the combination of words "quizizz", "teachers". Likewise, the search filters were applied: Open access and the temporal criteria of 2017-2023, giving a total result of 45 studies that were exported in the Bibtex format for later reading with Cran-R. Among the results, it was identified that 2019 was the year with the highest scientific production with 10 studies. Regarding the productivity of authors, it was found that 2 authors have presented continuity with the topic studied. On the other hand, the relationship between the keywords of the author, the authors and the affiliations included was interpreted. The frequency of words showed that the keywords with the highest index are "motivation", "Online games", "quizizz", "Technology", "gamification", "assessment" and "online teaching - learning". The countries with the highest production are Indonesia and India. Word co-occurrence within the abstracts of all included studies was then analyzed with a sample of 100 words from all abstracts. The studies with the highest citation index present (n=130) and (n=90).

Keywords: Quizizz, Study Methodology, Technology, Bibliometric Review.

1. INTRODUCTION

Currently the use and incorporation of technology in education, added to the idiosyncrasy of students at this time, it is more in their interest to learn by building than by reading; this implies that they will depend heavily on technology thus weakening their writing, as they were born in a technological society [1]. Within the teaching-learning process, assessment plays an important role because through various teaching strategies, students will achieve meaningful learning in which they will develop competencies, skills and abilities that will allow them to function in society [2].

One way to facilitate learning is through relevant strategies that develop cognitive skills in students to organize the given information through various mental processes such as organizing their time, working in an appropriate place and monitoring the activities to be performed [3]. The mark that the Covid-19 pandemic has left on humanity gives a new vision of education with the implementation of virtuality through online educational platforms-education [4].

There is a wide study of the tools used in education with a variability of results according to the objective sought, one of the most used has been the online questionnaires to evaluate academic achievement, which have achieved a great value of effectiveness in dynamic and efficient learning in students [5]. Another essential part of the teaching-learning process is motivation, the higher it is, the better results can be obtained with high levels of academic achievement; these are now called digital games that are applied in schools as teaching strategies to accompany students [6].

With a great potential for acceptance and motivation some applications such as Kahoot, and socrative, are managed in current education, they address specific questionnaires to develop a particular topic optimizing

learning without diverting the attention of students [7]. In the same way it is shown that Kahoot being an intuitive tool shows that students can learn new knowledge in a fast, attractive and fun way [8].

Education is currently supported by electronic and technological devices that allow students to interact and improve their learning, in which they can work with smartphones, tablets or other devices that make them work in real time (in class) or online, strengthening the teacher-student bond [9].

When referring to the evaluation under the Quizizz application, it is demonstrated that nowadays people learn new knowledge through different ways and different media, which allows them to build new knowledge [10]. Many studies suggest that the use of the Quizizz tool has a high demand of attention from students, promotes active participation increasing motivation so that a significantly enjoyable learning experience is reached. [11].

In the competency-based approach within the field of education, Quizizz is promoted as a new way of learning that proves to be of great impact on students, so that they develop digital competencies that quickly insert them into new knowledge [12]. The tool of gamification within education has taken great importance for both teachers and students, because it generates a fun, interactive learning experience that creates simple and engaging activities that lead to rapid learning progress [13].

The use of this tool as a teaching-learning methodology generates great advantages for students to obtain better and greater opportunities to assimilate the new knowledge acquired and above all provides the opportunity to generate feedback processes according to their participation [14]. These tools can be programmed with quizzes, true or false questions, multiple choice questions to which they will have access through a code sent by the teacher for interaction and at the same time monitoring it [15]. Digital environments provide various possibilities for interaction, forms of communication and knowledge exchange that allow students to have access to a better preparation to use different educational platforms and all the resources that are beneficial for their learning [16].

In relation to the aforementioned, the need to go deeper into the subject arises. The interest in analyzing the use of the Quizizz tool by elementary school teachers gives rise to the following general objective: To analyze the state of the literature published in the Scopus database. Therefore, the following specific objectives arise: To analyze the status of the annual scientific production from 2017-2023; in addition, to review the average number of citations per year; to identify the relationship between keywords, authors, and the sources consulted; to perform an analysis of bibliometric indicators according to sources of information on the most relevant sources and based on Bradford's law; to identify the production of authors over time, as well as the productivity of authors through Lotka's law; to verify the local impact of the authors according to the H, G, and M indexes; likewise, to know who are the most relevant sources; to identify the countries with the highest productivity; to study the indicators according to the authors and their published documents with the annual citations and their DOI identification; finally, to analyze the thematic evolution divided into 2 periods of time according to keywords. For this reason, the following question is posed: What is the state of the literature in relation to the use of the Quizizz tool by primary education teachers during the period 2017-2023?

2. METHODOLOGY

For the elaboration of the present research, it is proposed to use a personalized methodology of bibliographic review to analyze the literature in the interval of 2017-2023. The literature review follows the principles of the 4 laws of bibliometrics, the review quantifies variables and establishes metrics for its correct interpretation and analysis of the literature consulted [17], [18].

The literature search was conducted in the Scopus database. For this, the following combination of words was used: "quizizz" and "teachers", where a result of 45 studies was obtained during the period of 2017-2023. The analysis and compilation of the results, was carried out with the help of Cran-R hand in hand with the virtual library Bibliometrix. The customized methodology used for the present research is detailed in the following Table 1.

Table 1. Bibliometric methodological design.

Phase	Description	Classification
Phase I Questioning	During the next phase, the questioning of the topic is raised.	What is the state of the literature regarding the use of the Quizizz tool by elementary school teachers during the period of 2017-2023?
Phase II Efficient search	The topic was clearly defined, and the search keywords were identified in order to apply an efficient search using Boolean operators (AND, OR, NOT).	(TITLE-ABS-KEY ("quizizz") AND TITLE-ABS-KEY ("teachers")) AND (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2017))
Phase III Data collection	Data are reviewed by the authors for correct interpretation in order to identify, extract and normalize relevant data from the included studies: n = 45	**Published documents** • Period: 2017 – 2023 • Adjustment without country limit. **Bibliometric indicators:** a. Data Overview. b. Bibliometric indicators according to information sources. c. Bibliometric indicators according to authors. d. Bibliometric indicators according to authors' affiliation. e. Bibliometric indicators according to scientific production of the countries. f. Bibliometric indicators according to authors and published documents with DOI and citations by year. g. Bibliometric indicators according to Conceptual Structure.
Phase IV Construction of analysis material	The bibliometric indexes are calculated for their correct understanding through the use of figures and tables obtained with data from the "R" language and Bibliometrix.	**Visual representation of bibliometric indicators:** • Annual scientific production. • Average number of citations per year. • Three-Field Plot. • Most relevant sources • Bradford's Law. • Authors' Production over Time. • Authors' Productivity through Lotka's Law. • Authors' Local Impact H-Index, G-Index, M-Index. • Most Relevant Affiliations. • Countries' Scientific Production. • Most Global Cited Documents. • Thematic evolution 2017 - 2020. • Thematic evolution 2021 - 2023.
Phase V Drafting and conclusions.	The findings and results obtained are critically interpreted. The argumentation is made easy to understand and clear for its correct comprehension and reading.	The organization and evaluation of the results obtained in stages III and IV is carried out, based on the objectives and research questions posed in phase I. The main trends, patterns and relationships identified in the data analyzed are also detected, as well as the strengths and weaknesses of the scientific production, considering the existing literature and the importance of the findings for the field of study. In addition, conclusions are drawn that summarize the most relevant results of the research and its contribution to current knowledge.

During the results extraction phase, we executed Cran-R. Once the Scopus database has been consulted, the list of included research must be downloaded in BibTex format. When we run the program we will proceed to insert a support script that will link us to Bibliometrix, which is:

```
library(bibliometrix)

biblioshiny()
```

Once the script is loaded, cran-r will proceed to run the bibliometric analysis library. The BibTex file containing all the data of the consulted literature is inserted. Bibliometrix will show a data completion table, which reflects the status of the data read by the program for the correct use of the tool. Table 2 below shows the data read by Bibliometrix. For the present research, metadata with "Excellent", "Good" and "Acceptable" status were considered.

Table 2. Bibliometrix bibliometric data completeness table

Metadata	Descripción	Missing counts	Missing%	Status
AB	Abstract	0	0.00	Excellent
AU	Author	0	0.00	Excellent
DT	Document Type	0	0.00	Excellent
SO	Journal	0	0.00	Excellent
LA	Language	0	0.00	Excellent
PY	Publication Year	0	0.00	Excellent
TI	Title	0	0.00	Excellent
TC	Total Citation	0	0.00	Excellent
CR	Cited References	1	2.22	Good
C1	Affiliation	3	6.67	Good
DI	DOI	8	17.78	Acceptable
DE	Keywords	8	17.78	Acceptable
RP	Corresponding Author	24	53.33	Critic
ID	Keywords Plus	25	55.56	Critic
NR	Number of Cited References	45	100.00	Complete missing
WC	Science Categories	45	100.00	Complete missing

It is good to take into account the state in which a metadata is in order to consider assertive metrics, because a metadata with a poor reading state means that the metric will not consider much of the data from the literature consulted, therefore, it will be inaccurate with a high percentage.

3. RESULTS

3.1. Data Overview

3.1.1. Scientific Production

The scientific production according to Fig 1. shows the state of the literature during the period consulted. It is observed that 2017 started with 1 study, however, during the period of 2018 there was no study. Between the years 2019 to 2021 a growth of publications was detected starting with 6 studies during 2019, 10 studies for 2020 and finally reaching 17 publications for 2021, being the highest annual production rate. In the following years there was a reduction. All this suggests that the topic has awakened an interest within the research community, so it is important to delve deeper into the subject for future research.
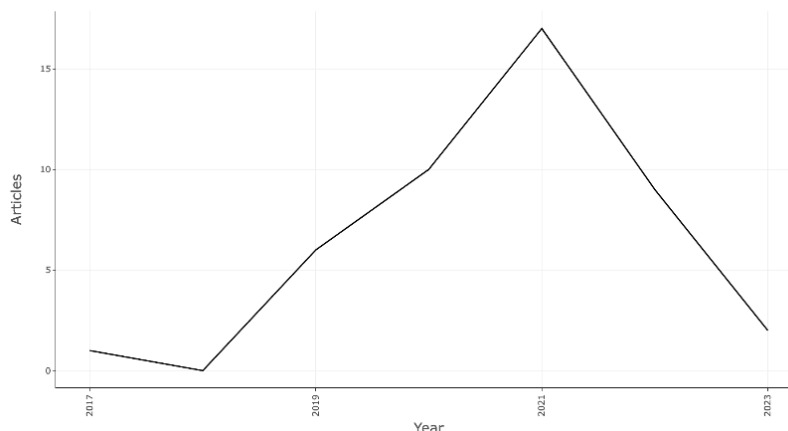
Figure 1. Diagram of annual scientific production in the interval 2018-2022. With application of "Cran-R" and Bibliometrix.

3.1.2.   Average Citations Per Year

Table 3 shows what is the status of the mean of total citations per year (MeanTCperYear) and the mean of total citations per article (MeanTCperArt). It is observed that in terms of MeanTCperArt, 2017 outperforms all with 90 citations for 1 article suggesting that such research has had an influence within the scientific community. 2018 is not included within the analysis as it does not present any published studies.

Table 3. Average citations per year

Year	MeanTCperArt	N	MeanTCperYear	Citable Years
2017	90	1	12.86	7
2019	26.67	6	5.33	5
2020	5.6	10	1.40	4
2021	4.65	17	1.55	3
2022	1	9	0.50	2
2023	0	2	0.00	1

3.1.3.   Graphic 3 Field

Fig. 2 shows the 3-field graph that identifies the interrelationship in this case between keywords, authors and sources in our study. It should be noted that we identified the dependent relationship of sources with respect to authors, and of authors with the most frequent keywords.
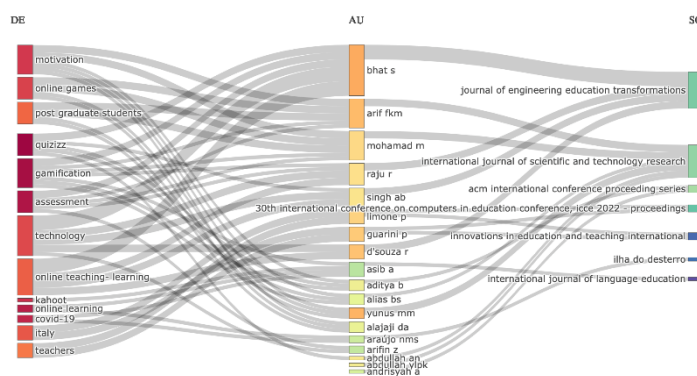

Figure 2. Three-Field Plot. Con aplicación "Cran-R" y Bibliometrix.

It is observed that the most frequent keywords regarding the use of the quizizz tool by primary education teachers are: "motivation", "Online games", "quizizz", "Technology", "gamification", "assessment" and "online teaching - learning". The authors with the highest frequency of the previously mentioned keywords are: Bhat S, Mohamad M, Arif FKM, Raju R, among others. And the most frequent sources based on the authors considered that mentioned the keywords are: "Journal of Engineering Education Transformations" and the "International Journal of Scientific and Technology Research", as shown in Fig.2.

3.2. Bibliometric Indicators According to Information Sources

3.2.1. Most Relevant Sources

Table 4 shows a list of the 10 journals considered the most relevant sources with their publication rates during the time interval.

Table 4. Most relevant sources

Sources	Articles
ACM International Conference Proceeding Series	3
AIP Conference Proceedings	3
International Journal of Scientific and Technology Research	3
Journal of Physics: Conference Series	3
Journal of Engineering Education Transformations	2
2nd Joint International Conference on Digital Arts, Media and Technology 2017: Digital Economy for Sustainable Growth, ICDAMT 2017	1
30th International Conference on Computers in Education Conference, ICCE 2022 - Proceedings	1
4th International Conference on Vocational Education and Training ICOVET 2020	1
Asian EFL Journal	1
Asian Journal of University Education	1

The sources "ACM International Conference Proceeding Series", "AIP Conference Proceedings", "International Journal of Scientific and Technology Research" and "Journal of Physics: Conference Series" have the highest number of articles produced, each one having published 3 articles. The "Journal of Engineering Education Transformations" presented 2 articles and the rest published at least one study. The table shows a wide variety of sources included in the present study.

3.2.2. Central sources by Bradford's Law

Bradford's law shows how the literature is dispersed in scientific journals to classify them in core zones. This law is used to identify the most productive sources within the field of study. It can be seen that the sources were classified in columns. In addition, there is the "Freq" column, which is the frequency of articles published by each source. The "CumFreq", refers to the cumulative frequency of all the sources included in the table. And finally "Zone" is the column that determines in which Bradford region the source is located.

The law is based on identifying the journals in concentric "zones" where zone 1 contains the highest frequency of published studies, but fewer journals. In this case, zone 1 contains 6 journals as shown in Table 5. Zone 2 concentrates fewer articles, but a greater number of sources. This table provides a useful overview of the dispersion of sources with respect to the topic under investigation and may be useful for other researchers to know which journals are the most relevant with respect to the field of study.

Table 5. Bradford's Law

SO	Rank	Freq	cumFreq	Zone
ACM International Conference Proceeding Series	1	3	3	Zone 1
AIP Conference Proceedings	2	3	6	Zone 1
International Journal of Scientific and Technology Research	3	3	9	Zone 1
Journal of Physics: Conference Series	4	3	12	Zone 1

Journal of Engineering Education Transformations	5	2	14	Zone 1
2nd Joint International Conference on Digital Arts, Media and Technology 2017: Digital Economy for Sustainable Growth, ICDAMT 2017	6	1	15	Zone 1
30th International Conference on Computers in Education Conference, ICCE 2022 - Proceedings	7	1	16	Zone 2
4th International Conference on Vocational Education and Training ICOVET 2020	8	1	17	Zone 2
Asian EFL Journal	9	1	18	Zone 2
Asian Journal of University Education	10	1	19	Zone 2

3.2.3. Bibliometric Indicators According to Authors

The following table shows the authors' production over time, where it is observed that the highest frequency is presented by Bhat S during 2021, with an index (n = 4) with a TC (Total Citation) equal to 16 and a TCpY (Total Citation per Year) of 5.3, which suggests that the author has had an impact within the scientific community interested in the use of the Quizizz tool by primary education teachers. Similarly, Arif FKM and D'Souza R presented frequencies of 2 studies published in 2020 and 2021 respectively.

Table 6. Author's production over time

Author	Year	Freq	TC	TCpY
Abdullah AN	2019	1	2	0.400
Arif FKM	2020	2	9	2.250
Bhat S	2021	4	16	5.333
D'Souza R	2021	2	8	2.667
Guarini P	2022	1	0	0.000
Guarini P	2023	1	0	0.000
Limone P	2022	1	0	0.000
Limone P	2023	1	0	0.000
Mohamad M	2020	2	9	2.250
Raju R	2021	2	8	2.667

3.2.4. Productivity of Authors Through Lotka's Law

Lotka's law determines the frequency of authors' productivity following the stated discipline of an inverse square distribution, suggesting that the number of authors producing a given number of studies is much smaller than the number of authors producing fewer studies. According to Fig. 3. about the investigated topic, the distribution in the graph does not strictly follow Lotka's law. However, the proportion of authors who have contributed to the field of study over time is seen to be smaller than the proportion of authors who have contributed at least one study.

In this case, it can be observed that at the beginning 120 authors (93%) have published at least one study during the period studied, but only 7 authors (5.4%) published 2 articles over time. As time progresses only 1 author (Yunus MM) ends up publishing 3 articles, representing 0.8% of the total. Finally, Bhad S is the author who remained stable publishing 4 articles and being represented by 0.8% of the total number of authors.

The analysis has determined that productivity is unequal to the number of authors in this field, which is consistent with Lotka's law. The results indicate that the research on the use of the Quizizz tool has been conducted in a collaborative environment.
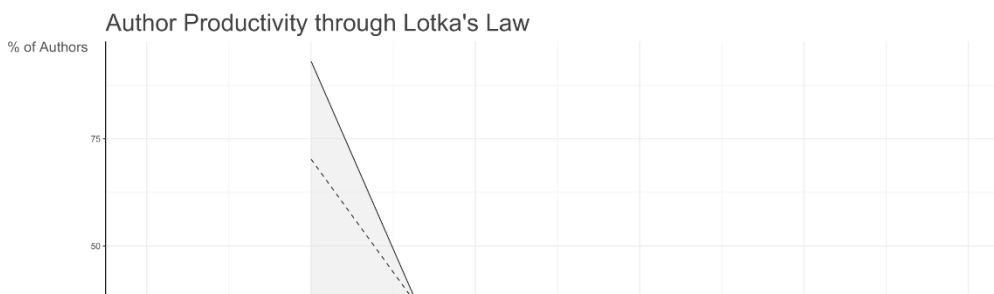
Author Productivity through Lotka's Law

Figure 3. Lotka's Law. Con aplicación "Cran-R" y Bibliometrix.

Table 7 shows the impact of the authors in the field of study based on their H, G and M indexes. As for the H-index, the highest index is 2 for 4 authors (Arif FKM, Bhat S, Mohamad M and Yunus MM). As for the G-index, it is observed that Bhat S and Yunnus MM have a value of 4 and 3 respectively. Finally, in the M-index, it is observed that Bhat S has a value of 0.667 since 2021, however, Yunnus MM has a value of 0.400 which does not necessarily mean that the first mentioned author has a greater impact, since they have the same H-index.

Table 7. Author's production over time

Element	H-Index	G-Index	M-Index	TC	NP	PY-Start
Arif FKM	2	2	0.500	9	2	2020
Bhat S	2	4	0.667	16	4	2021
Mohamad M	2	2	0.500	9	2	2020
Yunus MM	2	3	0.400	27	3	2019
Abdullah AN	1	1	0.200	2	1	2019
Abdullah YLPK	1	1	0.200	2	1	2019
Alajaji DA	1	1	0.333	2	1	2021
Alias BS	1	1	0.250	7	1	2020
Alshwiah AA	1	1	0.333	2	1	2021
ArifinZ	1	1	0.500	2	1	2022

The indices shown provide useful information on the productivity and impact of authors. It is important to emphasize that metric indices are an essential part of research, however, they do not capture the most important aspects of how an author performs in his or her field of study.

3.2.5. Bibliometric Indicators According to Author Affiliation

Table 8 is presented showing what is the production status of the most relevant affiliations within the studied field. ST Joseph Engineering College has published 6 articles during the time period of 2017-2023. Universitas Negeri Malang published 4 studies and Adiyaman University and Universiti Kebangsaan Malaysia have published 3 papers each. Thus, the table clearly frames the scientific production on the use of the Quizizz tool by primary school teachers.

Table 8. Most relevant affiliations

Affiliation	Articles
ST Joseph Engineering College	6
Universitas Negeri Malang	4
Adiyaman University	3
Universiti Kebangsaan Malaysia	3
Foggia University	2

Jagiellonian University	2
Universidade Estadual do Ceará	2
Universitas Negeri Surabaya	2
Universitas Pendidikan Indonesia	2
Universiti Putra Malaysia	2

3.2.6. Bibliometric Indicators According to Countries' Scientific Production
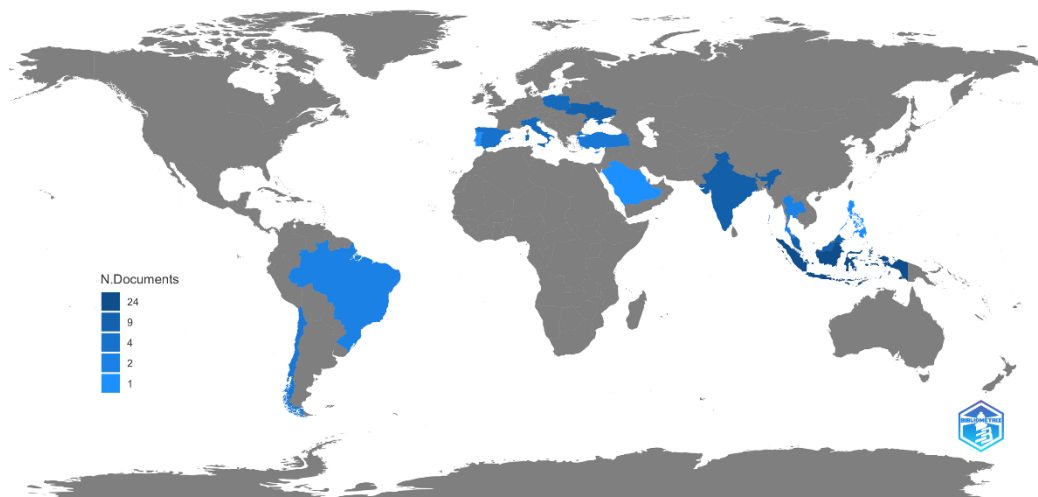

Figure 4. Countries' Scientific Production. Con aplicación de "Cran-R" y Bibliometrix

Fig. 4. shows the dispersion of literature around the globe. As can be seen, the literature is scattered in various regions of Europe, Asia and Latin America. The highest frequency belongs to Indonesia with (n = 24) published studies. India also has 10 studies. Other countries with higher rates include Malaysia, Ukraine, Italy, Poland, Spain, Chile and Turkey.

3.2.7. Bibliometric Indicators According to Authors and Published Papers with DOI And Citations by Year.

The most cited documents worldwide show in the first column, the paper, where the main author, the year and the name of the journal in abbreviated form, the second column shows the DOI of the study. The third column shows the total citations, then the total citations per year. Also, the total number of normalized citations.

It can be highlighted that according to the order of total citations the journal Computer and Education presents the highest total of citations equivalent to 130, with a TCperYear of 26. The author Chaiyo Y, published his study in 2017. So far there have been 90 citations and a TCperYear of 12.86. Compared to the previous author it has dropped by more than 50% because he has fewer citations and the time period from publication to the current year is longer than the first case. This suggests that the TCperYear is a very important indicator, however, it does not indicate the degree of relevance between papers because the publication dates are different and are ordered based on the total number of citations in this case.

Table 9. Most global cited documents

Paper	DOI	Total Citations	TC per Year	Normalized TC
Orhan Göksün D, 2019, Comput Educ	10.1016/j.compedu.2019.02.015	130	26.00	4.88
Chaiyo Y, 2017, Jt	10.1109/ICDAMT.2017.7904957	90	12.86	1.00

Int Conf Digit Arts, Media Technol: Digit Econ Sustain Growth, ICDAMT				
Hursen C, 2021, Tech Knowl Learn	10.1007/s10758-020-09458-2	22	7.33	4.73
Lim TM, 2021, Sustainability	10.3390/su13116436	18	6.00	3.87
Rodríguez DV, 2019, Profersorado	10.30827/profesorado.v23i3.11232	18	3.60	0.68
Ulla MB, 2020, Issues Educ Res	NA	17	4.25	3.04
Wiyono BB, 2021, ICEIEC – Proc IEEE Int Conf Electron Inf Emerg Commun	10.1109/ICEIEC51955.2021.9463846	15	5.00	3.23
Pitoyo MD, 2020, Int J Lang Educ	10.26858/ijole.v4i2.8188	12	3.00	2.14
Zuhriyah S, 2020, Univers J Edu Res	10.13189/ujer.2020.081132	8	2.00	1.43
Katemba CV, 2021, International Journal of Game-Based Learning	10.4018/IJGBL.2021070102	7	2.33	1.51

3.3. Bibliometric Indicators According to Conceptual Structure

3.3.1. Thematic Evolution

During this phase, the thematic growth was studied in relation to the authors' keywords. The thematic evolution was divided into 2 periods, the first from 2017 to 2020. Where it was highlighted that among the most basic themes were the words "assessment", "digital", "gamified test", "elements of game", "technology" and "washback effect". However, the analysis suggests that the study finds future developments in words such as "Quizizz", "Online Quizz", "Mobile learning", "Self-assess learning", "Kahoot", "Active learning", etc.

Figure 5. Thematic Evolution 2017-2020.

The second period is from 2021 to 2023, during which time the keywords "Quizizz", "Gamification" and "Teacher" were identified by degree of basic relevance. The analysis indicates that with respect to the degree of development and medium degree of relevance the words "Covid-19", "online-learning" and "Kahoot" managed to be of greater interest to the scientific community. This may have been triggered by the covid-19 pandemic crisis where the growth of informatics tools increased. The study suggests that within this last period of time the niche topics related to the use of the Quizizz tool are related to the words: "leaning management system", "engineering education", "technology", "assessment", "student engagement and motivation" and "online teaching-learning". These words can be considered to deepen the topic and awaken interest in new concepts and topics for future research.

Figure 6. Thematic Evolution 2021-2023

CONCLUSION AND DISCUSSION

Quizizz, is a tool that allows to pose questionnaires and evaluate them in real time, multiple choice, response times from 5 seconds to 15 minutes, the presentation of questions is randomly for each student, the teacher gets a score per student, which can be downloaded in Excel format [10]. It should be noted that the tool is free, requires a device connected to the Internet, whether it is a cell phone, tablet or computer; and the scoring system generates competition among students, therefore, the solution of the questionnaire is like a game where the winner is the one who gets the most correct answers and in the shortest time possible [11].

The literature review detailed a proposed methodology to know the state of the art in relation to the use of the Quizizz tool by primary education teachers during the period of 2017-2023. First, the year with the highest scientific production was explored, which was 2021, with a total of 17 published studies. Regarding the average number of citations per article, 2017 obtained an indicator of 90; while the indicator of the average number of citations per year was 12.86, with 7 citation years.

The results of the three-field graph identified the relationship between keywords, authors and their affiliations to determine the relationship between these and how it impacts the study of art; the most frequent keywords being: "motivation", "Online games", "quizizz", "Technology", "gamification", "assessment" and "online teaching - learning" are those with the highest frequency. The authors with the highest frequency of publication were Bhat S, Mohamad M, Arif FKM, Raju R, among others; while the sources where the most frequent keywords were mentioned were: "Journal of Engineering Education Transformations" and the "International Journal of Scientific and Technology Research".

The bibliometric indicators related to the authors included the exploration of Lotka's law that evidences the continuity of research on the same topic by the authors: Yunus MM and Bhad S. These authors obtained the highest values of the M-Index with values of 0.400 and 0.667.

The bibliometric indicator of scientific production by country identified that Indonesia is the country that contributes with 24 studies, followed by India with 10; therefore, it is defined that there is a lack of research on the topic in Peru. Finally, among the literature found, it was possible to identify that the highest citation indexes were (n=130) and (n=90), which means that the topic is of great contribution to the scientific community.

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