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Exploring Online Evaluation Development : A Bibliometric Approach

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Abstract: This study aims to explore the growth of online evaluation to give a comprehensive overview and identify research in the trending field and recommendations for further research that can be developed. This study used a bibliometric approach with descriptive methods from documents in the last ten years of the Scopus database. Quantitative and qualitative analyses were performed using data collected from numerous scientific reference sources to determine development trends, the most popular subjects, and the contributions of eminent scholars. The analysis's findings indicated that student evaluations of courses and teachers were the most commonly discussed subjects. However, in subsequent years, interest had changed to e-learning, higher education, assessment, and evaluation. Recent scientific articles further emphasized the significant impact Covid-19 had had on altering the evaluation process, placing particular attention on online learning. With the advancement of research on artificial intelligence in education, this study also outlined prospects and challenges in online evaluation research. We found thirteen publications covering Chat GPT for educational purposes by obtaining data from articles published in the most recent year in the Scopus database. This study offered a comprehensive view of the evolution of online evaluation through a bibliometric method, covered pertinent topics, and provided a basis for academics to carry out the most recent research in this area.

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Introduction

After assessing the outcomes or graduates generated, one can determine whether education has successfully attained its objectives. Education can be successful if the graduates' test scores meet the established educational objectives (Da Silva Santos et al., 2019; Wu et al., 2022) Education is viewed as a failure if it happens the other way around. It is possible to comprehend the significance of learning evaluation from this angle. As a result, learning evaluation plays a significant role in evaluating education. To gauge the degree of pupils' performance, learning is evaluated, albeit in a more constrained sense. Meanwhile, in a broader scope, learning evaluation is used to assess the success and weaknesses of a learning process in achieving the desired educational goals (Nurcahyono et al., 2020)(Zhang, 2021).

Learning evaluation is a requirement for everyone active in the field of education. Teachers can utilize learning evaluation to help them decide how to move education forward overall and in terms of individual students' achievement (Gysling, 2016). Each activity and choice made in connection with learning evaluation aims to produce better and more pleasing outcomes. Teachers always wish for better results than those obtained in the past. As a result, learning evaluation is required to ascertain and contrast these outcomes.

Vol. 9, No. 3 : September 2023
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Email: jklppm@undikma.ac.id

As a consequence, increasing the quality and quantity of education must be strengthened by improving the quality of teachers equipped with the necessary competencies in teaching. One of the skills that teachers need to have is pedagogical competence, and a key component of this skill is being able to evaluate learning effectively (DeLuca et al., 2016). Teachers with pedagogic competence can better organize, carry out, and assess the learning process. The instructor can determine the pupils' level of comprehension and progress and if the learning objectives have been met or still need improvement by evaluating learning. Through learning evaluation, the teacher can pinpoint each student's strengths and shortcomings to offer advice and assistance. In addition, the evaluation also helps teachers to adapt teaching methods that are more in line with the needs and characteristics of individual learners (Kim et al., 2015)(Shevchenko et al., 2020)(Xiaoyu, 2018). Therefore, raising the caliber of teachers in pedagogic competence, including mastery of learning evaluation, will significantly aid in successfully and efficiently achieving educational objectives. Teachers skilled at evaluating student learning will contribute to creating a perfect learning environment where students can fully realize their learning potential.

Triggered by the Covid-19 pandemic, which changed learning from face-to-face to online, there was a change in the form of evaluation. Due to inadequate planning, the abrupt transition from in-person to online instruction entails several downsides and implementation challenges (Rotar, 2024; Vaca-Cartagena et al., 2023). The reality is that students and professors still need to be sufficiently prepared for online learning. The fact that educators have yet to switch from delivering lessons face-to-face to presenting lessons for online learning is an illustration of a failure on their part. Meanwhile, students' shortcomings may manifest as a lack of physical or mental adaptability to shifts from in-person learning to online learning (Alhaider, 2023).

Students must be prepared to participate in online learning by adjusting their learning environments, learning activities, learning technologies, and existence when learning. Students may only meet learning objectives to the fullest extent if they are adequately equipped to conduct online learning during the Covid-19 epidemic, particularly in evaluation (Muhaimin et al., 2023)(Tuah & Naing, 2021). With the switch to online evaluations, some challenges arise, including (1) educators' difficulty planning the type of technology-based assessment to be used, (2) educators' limited ability and creativity to present online evaluations, and (3) educators' difficulty determining the authenticity of student answers because they did not interact with the students in person, so it is unclear whether these answers can accurately reflect students' abilities or whether students were given answers (Al-Maqbali & Hussain, 2022; Beleulmi, 2022; Musdalifah et al., 2022). By seeing the importance of online evaluation for current learning and by realizing that it is necessary to develop research on online evaluation, the purpose of this research, through bibliometric analysis, is to identify research in the field of online evaluation that is trending and recommendations for further research that can be developed.

Research Method

This study used a bibliometric approach with descriptive methods. Data processed using a bibliometric approach were article documents that had been published in journals indexed in Scopus, which focused on online evaluation over the last ten years, from 2013 to 2022. The following steps were taken to obtain the Scopus database.

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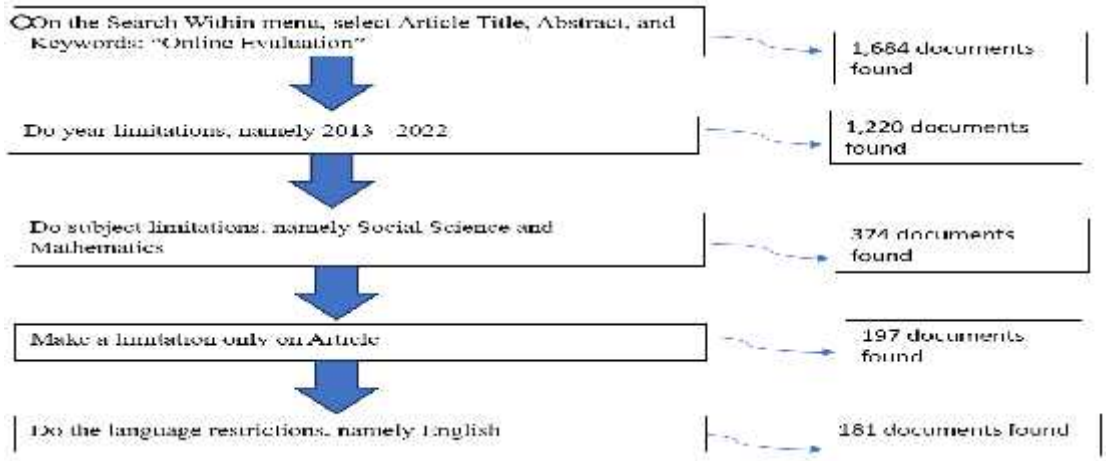

Figure 1. Stages in obtaining data in the Scopus Database

Table 1 shows the explanation of the consideration of each limitation undertaken in the present study.

Table 1. Descriptions of Some Undertaken Limitations

Limitations	Descriptions
Years	The last ten-year period was chosen because the researchers wanted to know a comparison of the development of Online Evaluation before and after the Covid-19 Pandemic. This was based on the fact that since the Covid-19 pandemic required face-to-face learning, learning evaluation was also carried out online (Basitere et al., 2023; Kampamba et al., 2023).
Subjects	The subjects of Social Science and Mathematics were chosen because the articles that would be explained were about online evaluation in the context of learning, especially in learning mathematics, and not in other fields (Nisbet, 2022).
Article Type	Articles were chosen as the focus of research because of the higher reliability and novelty of information compared to conference papers, reviews, and book chapters. Articles often contained the latest research results and more up-to-date information in a particular field, making them a more reliable option for online evaluation research in mathematics and social science subjects.
Language	English was chosen as the main language in this study because it was the most commonly understood international language and was often used in scientific article publications. By using English, research results would be accessible and understood by more readers from various countries and scientific backgrounds, thus expanding the impact and reach of information conveyed in online evaluation research on mathematics learning and Social Science subjects.

As previously mentioned, selecting the "Article Title", "Abstract", and "Keywords" menus with the word online evaluation resulted in 1,684 documents. More specifically, the obtained data were as follows:

1) If only "Article Title" was selected which contained the words *online evaluation*, then there were 287 documents.
2) If only "Abstract" was selected which contained the words *online evaluation*, then there were 1,391 documents.
3) If only "Keywords" was selected which contained the words *online evaluation*, then there were 262 documents (VoS Viewer APP)

Finally, 181 suitable articles were chosen after the selection process that better suited the research topic. Figure 2 explains the document processing.

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Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
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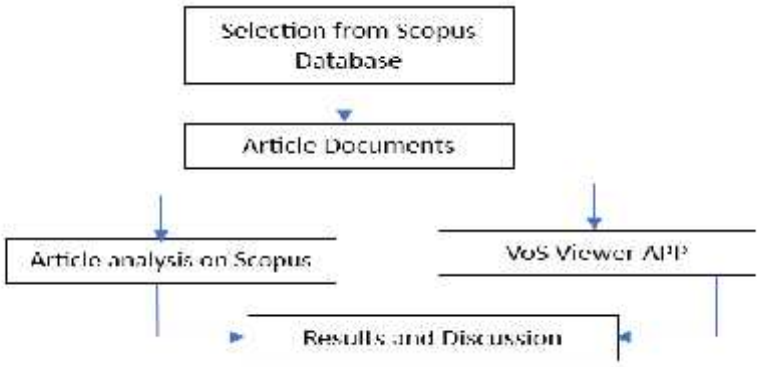

Figure 2. Research Flow

Quantitative and qualitative analyses were performed using data collected from numerous scientific reference sources to determine development trends, the most popular subjects, and the contributions of eminent scholars.

Results and Discussion

a) Development of the Number of Articles on Online Evaluation

Articles on the issue of *online evaluation* had been published every year since 1983, even though there were only at most four documents up until 2000. In 1969, there was only one relevant article. In 1976, there was only one article again. However, since 2001, more documents have suggested that there has been more research on the subject of *online evaluation*. An article on online evaluation was first published in 2002, especially on education. The usage of online evaluation for student volunteers at a tertiary institution was discussed in this study, along with user characteristics and the best available online evaluation technology. Since then, studies and publications on online evaluation in educational contexts have gained more significance and are expanding quickly in the Scopus database(Grabe;, 2002). Figure 3 shows the rrrrrr of documents from 2013 to 2022 in accordance with the restrictions set forth for this article.

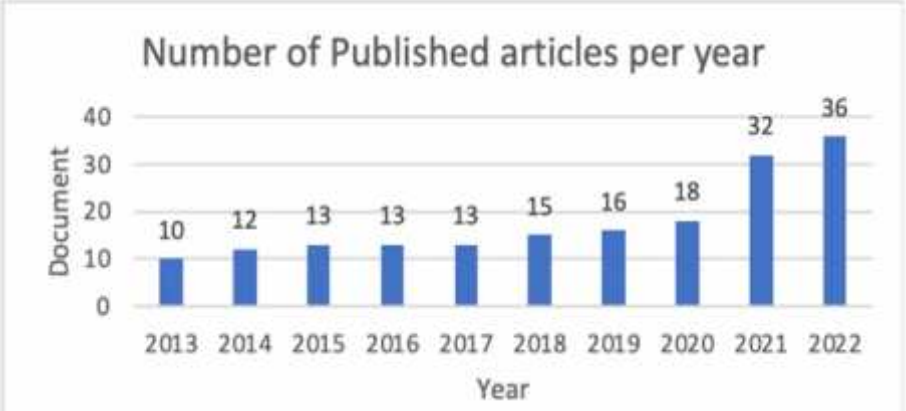

Figure 3. Number of articles on the topic of *online evaluation* per year

Figure 3 shows that there were more documents on the subject of online evaluation each year. The highest jump occurred from 2020 to 2021 when there were fourteen documents, and the trend continued until 2022 when there would be thirty-six documents. Because of this rise, which was linked to the COVID-19 outbreak in 2019, the learning process must be done online, including assessments (Amzalag et al., 2022; Arifin & Setiawan, 2022)

b) Analysis of Journals Containing Articles on *Online Evaluation*

Figure 4 shows the top five journals that had articles on the topic of online evaluation

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
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Vol. 9, No. 3 : September 2023
E-ISSN: 2442-7667
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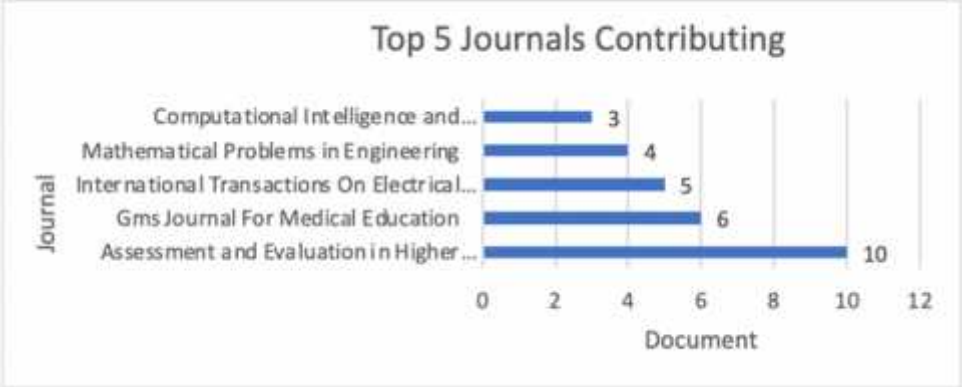

Figure 4. Top five journals containing articles on *online evaluation*

Based on the information in Figure 4, the Journal of Assessment and Evaluation in Higher Education, a Taylor & Francis journal, published the most articles discussing *online evaluation*, with ten articles appearing from 2013 to 2019. Four papers were published in 2013, two in 2014, one in 2016, three in 2018, and three in 2019. Additionally, the Gms Journal for Medical Education had four papers published in 2020 and two articles in 2021, as the second rank.

One article, with 49 citations, had the most citations out of the 10 articles published in the Assessment and Evaluation Journal in Higher Education. Using information from RateMyProfessors.com, which included 7,882,980 assessments, this research explored how students saw online evaluation. According to the study's findings, instructors in the social humanities received higher ratings than those in the sciences and engineering when facilitating online reviews. Exploring gender disparities was also an intriguing topic (Rosen, 2018). According to this article, since 2018, researchers had started to be concerned about and interested in the topic of online evaluation.

c) Publications by Country

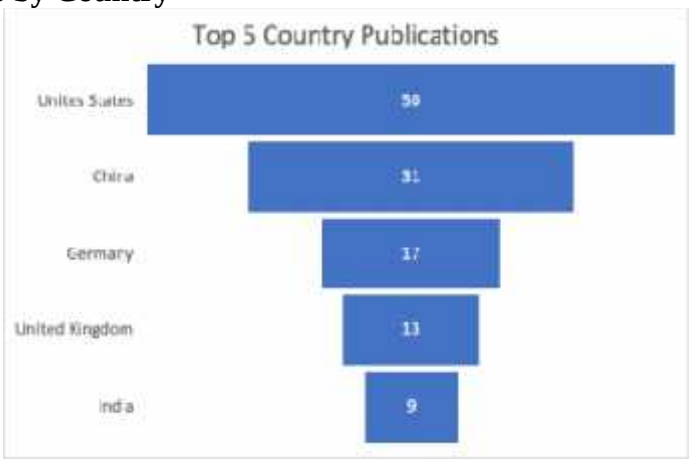

Figure 5. Author's Country of Origin

In accordance with Figure 5, America was in first place with fifty documents related to online evaluation from 2013 to 2022. The highest number of publications occurred in 2015, with nine documents. Meanwhile, China ranked second with a total of thirty-one documents, and there had been a significant increase in publications starting in 2021, with eleven documents, and increasing again to twelve documents in 2022. It can be seen in Figure 5. Furthermore, Indonesia also contributed to research on online evaluation by publishing three documents in 2020, 2021, and 2022, showing research by lecturers in Indonesia on online evaluation. Figure 6 shows the density of each country perceived through the Vos Viewer.

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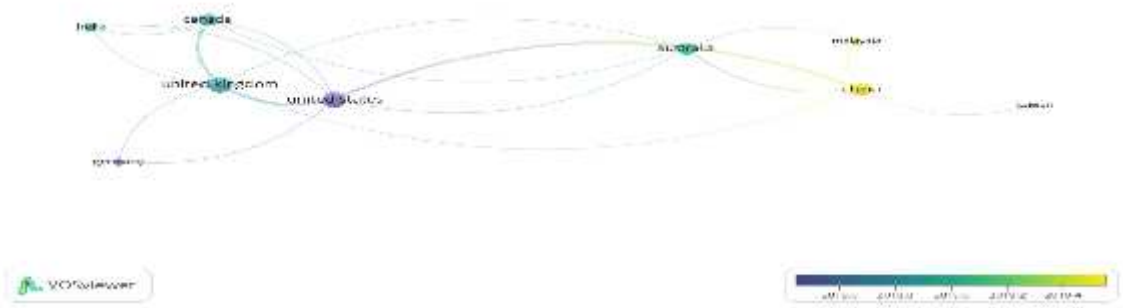

Figure 6. Figures by Country with the most recent year of publication

Figure 6 explains that countries such as the United States, United Kingdom, Canada, Germany, and India were joined in one cluster called cluster 1. In contrast, Australia, China, Taiwan, and Malaysia were joined in cluster 2. Each cluster showed that countries often had articles written together on *online evaluation*. In addition, China stood out as the country with the most recent articles, highlighted yellow in the image. It showed that China carried out the latest research in online evaluation. Joint research between countries within the same cluster demonstrated intensive collaboration and knowledge exchange on online evaluation. Meanwhile, the emphasis on China as a country with recent articles showed their commitment and contribution to developing knowledge about online evaluation.

d) Authors

Figure 7. Top five authors contributing to an article on *online evaluation*

According to Figure 7, Sarah McGrew, a professor in the College of Education at the University of Maryland in College Park, had written the most articles, four in all. Sarah McGrew has published four articles; of those, she received 169 citations. Sam Wineburg from Stanford University co-wrote the articles with the most citations, published in 2019. The hunt for experts in online evaluation was discussed in the article in order to comprehend their methods and tactics for assessing digital content in order to teach readers about educational initiatives and ensure that pupils were given accurate and truthful information online (Wineburg, Sam ; McGrew, 2019). Meanwhile, Sam Wineburg himself had written three articles, with two articles published in 2022, and the total number of citations received reached 118. The following illustrated the density between authors in the results of the Vos Viewer analysis, which showed how often writers collaborated in producing articles (see Figure 8). For example, in cluster 1, authors Li C, Li J, Liu Y, Pan Y, Wang Z, and Zhang S were noted for frequently co-writing in collaboration. Meanwhile, the authors Liud.-r, Rozza G, and Wang Q were recorded as single authors, which meant they had never collaborated with other authors in writing articles. To find out the level of novelty, authors with a lighter color indicated that they had articles with a newer year of publication than authors with a darker color. For example, Wang Q and Pan Y had articles published in 2022, indicating that their articles fell into the newer category.

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
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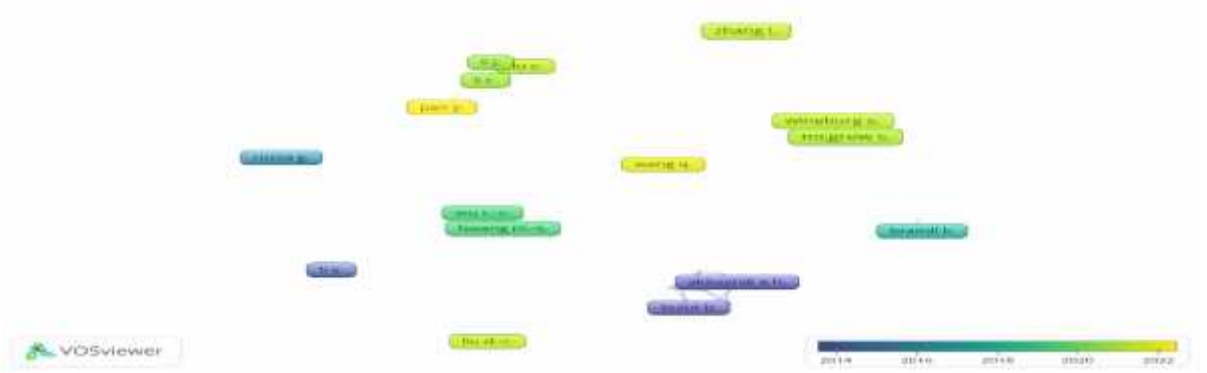

Figure 8. Visualization Author Density

e) Keywords

From the results of data analysis based on keywords with a minimum number of occurrences of five out of a total of 596 keywords, ten keywords were identified and met these criteria. Furthermore, these keywords were divided into three clusters with different colors: red, blue, and green. In the red cluster, there were four keywords, namely "assessment," "course evaluation," "e-learning," and "online evaluation." In the green cluster, there were three keywords, namely "covid-19," "evaluation," and "online learning." The blue cluster contained two keywords, namely "higher education" and "student evaluation of teaching." Through the overlay visualization, as shown in Figure 6, it could be observed that the latest article on "Online Evaluation" was related to the keywords "covid-19" and "online learning." It meant that the latest "Online Evaluation" articles discussed its relation to the Covid-19 pandemic and online learning.

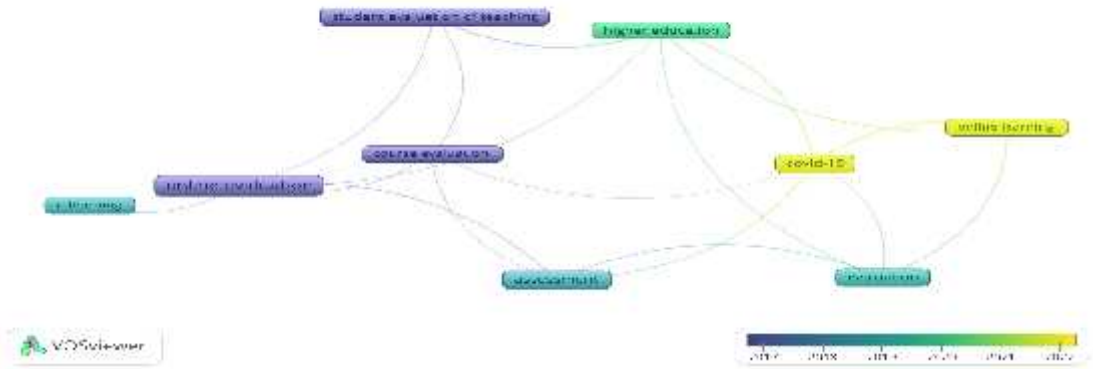

Figure 9. Keyword overlay visualization

According to Figure 9, the most recent scholarly papers on online evaluation released in 2022 focused on Covid-19 and online learning. In publications dated before 2019, there was a greater emphasis on the relationship between learning and assessment and evaluation of learning from learning, and there was less discussion of online evaluation. For instance, one of the articles from 2022 described teachers' experiences doing online assessments while utilizing a gamification strategy to grade quizzes. This article indicated that teachers' needs for online evaluation differed depending on the material, content, media, or process used. As a result, it was everyone's duty to offer the proper training to suit teachers' needs for online evaluation. These recent studies, focusing on COVID-19 and online learning, showed substantial changes in the evaluation process and how technology was used in education, notably in addressing pandemic issues and the growth of remote learning (Arifin & Setiawan, 2022). The necessity of online evaluation following the COVID epidemic was eloquently

Vol. 9, No. 3 : September 2023
E-ISSN: 2442-7667
pp. 1019-1030
Email: jklppm@undikma.ac.id

covered in this article. Prior to 2019, some of the papers described the assessment concept in general but still needed to provide online evaluations. Students in the health sector were divided into two groups: the control class and the experimental class. Students used to take a pretest before receiving a posttest in the past. According to the study, in-person evaluations had superior outcomes to online evaluations. This article was pertinent because it compared the outcomes of face-to-face and online evaluations and emphasized the value of online evaluation during the COVID-19 pandemic. It could help policymakers and educators choose an acceptable and efficient evaluation technique, particularly post-pandemic learning (Chen et al., 2017).

Discussion

Similar to the growth of online learning papers, articles on online evaluation themes have accelerated yearly, particularly since 2019, when a pandemic struck every nation. Between 2020 and 2021, the number of articles about online evaluation increased by 44%. According to the currently available data, it took one to two years before articles about online learning finally appeared after online learning and evaluation practices had taken place. It was because, in the early years of the pandemic, the world of education was still stuttering and not at all prepared to face online learning (Kusnadi, Yanti Hamdiyati, Peristiwati, Any Fitriani, Purnamaulida Pratiwi, Fitri Husni, 2021; Masfuah et al., 2021). According to the Scopus database on online learning, there was an additional 48% of articles between 2020 and 2021, which was in line with the addition of papers about online evaluation.

With a total of ten articles, the Journal of Assessment and assessment in Higher Education was noted as having the most articles in the area of online assessment among those that had been published. Intriguingly, this journal also published nineteen pieces on online learning at that time. The journal also kept publishing articles about online learning from 2020 to 2022, but no new articles about online evaluation was published. This information indicated that due to its wider and more thorough coverage, the issue of online learning was more in demand than online evaluation (Suciati et al., 2021). The second-highest number of publications in online evaluation were found in the Gms Journal for Medical Education. In contrast to the Journal of Assessment and Evaluation in Higher Education, this journal featured articles that were published in a more recent year. The Gms Journal for Medical Education was committed to updating publications on online evaluation, as evidenced by the fact that in 2021, it continued to publish studies on the subject actively.

Following the discussion of journals as a source of references in articles, it was crucial to consider the nation since it illustrated the amount of research activity in the subject area. Over the past ten years, the United States, a sizable nation, generated the most online evaluation articles. Data from the Scopus database revealed that, out of fifty articles published by American researchers, six articles were published in the journal Assessment and Evaluation in Higher Education. In comparison, two articles were published in Evidence Based Library and Information Practice, Journal of Extension, and Journal of Higher Education Theory and Practice.

However, a different situation occurred in China, the country with the second-largest number of publications. In China, the most published articles were in Mathematical Problems in Engineering, followed by Energies. Meanwhile, in the journal Assessment and Evaluation in Higher Education, only one article was published, showing the difference in the level of research contribution in online evaluation between the United States and China. In addition to the number of articles on the topic of online evaluation, it was also essential to pay attention to the citations obtained by the authors because the number of citations can reflect the quality and novelty of the article. Table 1 shows the information regarding citations.

Vol. 9, No. 3 : September 2023
E-ISSN: 2442-7667
pp. 1019-1030
Email: jklppm@undikma.ac.id

Table 1. Top five Authors, Affiliations, Languages, Multiple Articles, Number of Citations on the topic of Online Evaluation

Authors	Affiliation	Language	Numbers of Articles	Total Number of Citations	The highest number of citations in an article
Mc Grew, S	University of Maryland, Catonsville, United States	English	4	174	100
Wineburg, S	Graduate School of Education, Stanford University	English	3	122	100
Cukadar, S	Istanbul Bilgi University	English	2	1	1
Celebi, Mustafa, K	Çukurova Üniversitesi, Adana, Turkey	English	2	1	1
Wu, C.C	National Quemoy University, Taiwan	English	2	5	3

From Table 1, it can be seen that the authors McGrew S and Wineburg had collaborated to produce an article published in 2019, and the article received 100 citations. This article discussed skills in online evaluation to understand strategies and approaches in assessing digital content (Wineburg & McGrew, 2019). Furthermore, the authors who produced newer articles came from China (see Figure 8). Based on data from the Scopus database, both Wang Q and Pan Y had published an article in 2022, even though it was only one article.

Discussion of keywords was important and interesting because, from the keywords, readers could see the topic trends of an article. Figure 9 shows that the topics "covid 19" and "online learning" were relatively new, marked with a lighter color. The topic of "covid 19" was widely discussed with "assessment," although there was also a connection with "evaluation," but in terms of novelty, it was more related to "assessment." It was caused by the difference between "evaluation" and "assessment," namely the purpose and scope of their use. The evaluation focused more on assessing the overall performance of a program or activity and sought to assess its impact and effectiveness more broadly. Meanwhile, assessment focused more on individual assessment and was more related to measuring learning outcomes or achieving specific goals (Mukrimaa et al., 2014; Scheerens et al., 2012; Tomas de Aquino, 2020). Both were an important part of developing and improving the quality of a program or education. This trend showed that "online evaluation" was still relatively new and used more of the keyword "assessment." More results were obtained from the Scopus database, with the same limitations as the "online evaluation" topic, namely 495 documents. It confirmed that the "assessment" topic was newer than the "evaluation" topic. Therefore, it was more appropriate to use the topic "assessment" for further research. For example, one of the articles with the topic "assessment," published in 2023, linked it to artificial intelligence. This article tried to contribute to the topic of online assessment by utilizing Chat GPT (Generative Pre-trained Transformer) in the world of education, which was still being debated about its impact (Naidu & Sevnarayan, 2023). However, the article emphasized that the positive impact of Chat GPT was more pronounced than the negative impact if it was used correctly in conducting an assessment.

The conceptual implications of this research lie in the development of online evaluation, which inherently differs from conventional evaluation. Online evaluation implies a distinct approach to crafting questions compared to offline evaluation, for example,

Vol. 9, No. 3 : September 2023
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pp. 1019-1030
Email: jklppm@undikma.ac.id

generating questions that encourage students to minimize dishonesty due to the absence of supervision during exams. Additionally, application development should also support an enjoyable evaluation process for students. Therefore, the conceptual implications extend to question generation and application development techniques, necessitating a more thorough design to create online models across various Technology-Enhanced Learning platforms. The practical implications of this study are that students can identify weaknesses and strengths in their test results. It is facilitated by applications in online evaluation that assist students in understanding the weaknesses and strengths of specific topics, as well as how students can promptly recognize and rectify errors through self-directed learning evaluations.

Conclusion

The results of this study conclude that student evaluations of courses and teachers were the most commonly discussed subjects. However, in subsequent years, interest had changed to e-learning, higher education, assessment, and evaluation. Recent scientific articles further emphasized the significant impact COVID-19 had had on altering the evaluation process, placing particular attention on online learning. With the advancement of research on artificial intelligence in education, this study also outlined prospects and challenges in online evaluation research. We found thirteen publications covering Chat GPT for educational purposes by obtaining data from articles published in the most recent year in the Scopus database. This study offered a comprehensive view of the evolution of online evaluation through a bibliometric method, covered pertinent topics, and provided a basis for academics to carry out the most recent research in this area.

Recommendation

Based on the existing conclusions, recommendations that can be offered to researchers involve the advancement of research on evaluation involving artificial intelligence, such as question generation or applications that enable learners to evaluate their work, thereby allowing them to learn from mistakes to avoid repeating the same errors.

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Vol. 9, No. 3 : September 2023
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