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A Comprehensive Bibliometric Analysis of Distance Learning Assessments: Key Themes and Future Directions

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A B S T R A C T

Distance learning has become increasingly relevant, mainly fuelled by advances in information and communication technology (ICT) and emergency situations such as the COVID-19 pandemic. Innovations in assessment and evaluation methods are key to improving the quality of education in the context of distance learning. This study aims to identify, analyse and map the main themes and provide recommendations for new directions for future research related to distance learning assessment. This research is quantitative-descriptive in nature using bibliometric analysis techniques. Bibliographic data was taken from a credible scientific database on the Scopus database in the range of 2020-2024 using the keyword 'Assessment for distance learning'. The data obtained was analysed and the relationship between keywords was mapped. Based on the results of the analysis it can be concluded that the 10 major themes and research trends related to distance learning assessment include distance learning (131), higher education (43), e-learning (40), distance education (34), Covid-19 (30), assessment (24), pandemic (23), blended learning (17), online assessment (16), online education (15). The results of this study can provide a framework for understanding distance learning assessment in a broader and cross-disciplinary context

INTRODUCTION

In recent decades, distance learning has become increasingly relevant, mainly triggered by advances in information and communication technology (ICT) and emergency situations such as the COVID-19 pandemic. Distance learning allows students to learn without being bound by physical location, which provides significant flexibility in the educational process. The technologies used in distance learning, such as online learning systems and e-learning platforms, have proven effective in supporting the teaching and learning process. For example, research by Yerusalem et al. (2015) shows that the implementation of distance learning systems can save costs and time, as well as increase the effectiveness of material delivery. In addition, Aedi et al. (2022) emphasized that the use of digital technology in distance education can expand learning resources and increase educational accessibility for students. Online learning during the pandemic is able to improve students' knowledge, skills, mastery of technology, autonomy, creativity, and independence, and shows the readiness of institutions to implement distance learning (Maman et al., 2021; Romadin et al., 2022).

However, the implementation of distance learning also faces various obstacles. Kurniasih et al. (2022) noted that although distance learning can be conducted in early childhood, challenges such as children's inattention and internet network instability often hinder the effectiveness of learning. Research by Humaera & Rusdinal (2021) also shows that although teachers' performance in distance learning is quite good, there are obstacles faced by both teachers and students. Therefore, it is important to identify and overcome problems that arise during the implementation of distance learning so that the learning process can take place more effectively.

In order to improve the effectiveness of distance learning, some studies suggest the development of more adaptive media and evaluation methods. For example, research by ali and sukardi proposed the development of an evaluation model that can facilitate teachers in conducting assessments during distance learning (M. K. Ali & Sukardi, 2021). In addition, the use of electronic portfolios as an assessment instrument is also proposed to improve the efficiency and effectiveness of assessment in the digital era (Masluhah & Afifah, 2022). Thus, innovation in assessment and evaluation methods is key to improving the quality of education in the context of distance learning.

Research on distance learning has been growing rapidly, but systematic reviews of key themes and future research directions in the field of assessment are limited. This study aims to identify, analyze and map the main themes and provide recommendations for new directions for future research in distance learning assessment. The novelty of this research lies in the effort to develop a bibliometric analysis to identify the main themes, research trends, and knowledge gaps in distance learning assessment. This theoretical approach has not been widely used in distance learning literature, especially in the context of bibliometrics. The results of this study can serve as a basis for developing regulations that support the integrity and inclusiveness of distance learning assessment for policy makers. For academics, this research provides a

framework for understanding assessment in a broader and cross-disciplinary context.

This research uses a bibliometric approach to systematically, quantitatively and data-driven explore the literature to reveal patterns, inter-topic relationships and opportunities for future study development.

1. Type of Research

This research is quantitative-descriptive in nature using bibliometric analysis techniques. This approach aims to map the literature thoroughly and in-depth based on metadata of relevant publications, such as journal articles, conference proceedings, and books, to understand the contributions of previous research as well as identify themes and future research directions.

2. Data Sources

Bibliographic data were retrieved from credible scientific databases on the Scopus database, for global coverage of high-quality research. The inclusion criteria for this study are: publications within 2020-2024, focus on assessment in distance learning, articles in English or those with English abstracts.

METHODOLOGY

3. Data Collection Process

The data collection process was carried out through the following steps:

a. Keyword Search: Using keywords such as: "Assessment for distance learning".

b. Data Filtering: Using publish or perish software to ensure data quality and relevance.

c. Metadata Extraction: Metadata collected included title, abstract, keywords, author name, institution, year of publication, and author keywords.

4. Data Analysis

The data obtained was analyzed using a combination of the following tools and methods:

a. Visualization: To map the relationship between keywords, co-citation analysis, and the relationship between keywords, VOSviewer software was used.

b. Trend Analysis: We used VOSviewer software to identify publication trends by year, topic, and geographic distribution.

c. Identification of Major Themes: We used co-occurrences analysis to identify key themes in the research, such as: Strongly interlinked keywords

d. Knowledge Gap Analysis: Mapping the latest relevant keywords and rarely discussed

5. Validity and Reliability

Internal validity was maintained by ensuring that only articles that met the inclusion criteria were analyzed. Reliability was done by repeating the search and analysis process by two independent researchers to minimize bias.

6. Expected Results

The results of this study will present:

a. mapping of key themes and research trends in distance learning assessment.

b. Visualization of the global research network, including linkages between keywords.
c. Identification of research gaps to direct future studies.

This method is designed to make a significant contribution to understanding the distance learning assessment research landscape and provide strategic insights for academics and practitioners.

RESULT AND DISCUSSION

VOS viewer is a software tool developed to visualize bibliometric networks, which can include networks of scientific publications, researchers, or keywords. It uses a visual representation that allows users to explore relationships and clusters in the data.

Mapping Of Key Themes And Research Trends In Distance Learning Assessment

VOSviewer automatically identifies clusters based on the proximity of items in the visual space. Items that are grouped together form different clusters. Clustering in VOSviewer is based on co-occurrence data, where items that frequently co-occur are grouped into clusters. Clustering of items can be seen in Table 1 below.

Tabel 1. Clustering Items In Distance Learning Assessment

Cluster	Keywords
Cluster 1 (18 items)	asian history, asian history, authentic task, demotivating online formative assessment strategies (dofas), distance education challenges, e-portfolio, educational transformation, lecturer, motivation, odl implementation strategies, online assessment, online exams, open distance e-learning, open distance learning (odl), phenomenography, south africa education system, students' performance, traditional assessment
Cluster 2 (15 items)	attitude to distance learning, compassion, digital devices, diseases and conditions, education, educational activities, health, learning and learning models, mental health, mental wellbeing, participatory, schoolchildren, social model, students, universities
Cluster 3 (15 items)	distance education, education quality assessment, family and community medicine, healthy lifestyle, information and communication technologies, interpersonal relations, m/m/m and m/g/m/k techniques, preceptorship, questionnaire

	method, safety disciplines, server device performance, state of health, teacher, teacher's work rationing, technical issues in remote learning
Cluster 4 (14 items)	agent, assessment, assessment method, authentication, biometrics, competency-based assessment, e-assignment, emerging technology, learning management system, learning outcomes, medical education, security, self-assessment, student peer assessment
Cluster 5 (13 items)	authenticity, confirmatory factor analysis, continuous assessment, lifelong learning, online information resources, open and distance learning, perma model, programming, reliability, sub-saharan Africa, undergraduate students, validity, well-being
Cluster 6 (13 items)	covid-19, crmef, educational institutions, engineering, epidemic, incidence, k-12, laboratory, psychomotor, remote learning, saratov region, satisfaction, trainee teacher
Cluster 7 (13 items)	alternative assessment, covid-19 pandemic, e-resources, factors influencing distance learning, forced distance learning, mathematics teachers, obstacles, online education, online lecture, online seminar, quality assessment of higher education, sociological survey, university
Cluster 8 (12 items)	adaptation, barriers, compatibility, competency, faculty, frustration, higher education institution, online distance learning, program content, readiness, student lifestyle, workload
Cluster 9 (12 items)	assisted language learning, blended learning, course evaluation, hybrid teaching, instructor's performance, mobile technology, service learning, student participation, student satisfaction, student-instructor interaction, technologies in education, telelearning
Cluster 10 (12 items)	eye of the theoretician, formative assessment, long distance learning, mathematics education, open-book examination,

	personal contact, programme, summative assessment, teacher identity, teachers' beliefs, term-end examination
Cluster 11 (11 items)	a questionnaire, academic writing skills, design guidelines, english language, high education, moodle, networking, peer assessment, personality psychology, practice base, remote teaching
Cluster 12 (11 items)	assessment ethics, assessment in higher education, dental education, face-to-face session, online continuous assessment, online learning, pandemic of covid-19, postgraduate learners, practical skills, social justice in assessment, survey
Cluster 13 (10 items)	academic integrity, assessment design, cheating, mathematics, redesign, smart education, teaching-learning-evaluation dynamics, technology, theory of moral disengagement
Cluster 14 (9 items)	digital literacy, e-learning, european languages, hybrid learning, lms, method, oriental languages, survey study, usability
Cluster 15 (9 items)	digital transformation, digitalization of education, distance learning technologies, educational inequality, educational resources, learning management system (lms), pandemic, problems and consequences of the transition to e-learning, quality of education
Cluster 16 (8 items)	collaboration, community of practice, connectivism, digital pedagogy, environmental education, higher education, pre-service teachers, technological competencies
Cluster 17 (8 items)	computer, involvement in the educational process, laptop, longitudinal study, quality of knowledge, quality of skills forming, smartphone, university students
Cluster 18 (6 items)	academic performance, assessment techniques, distance learning, face-to-face learning, management undergraduates, plagiarism
Cluster 19 (6 items)	debate, digital skills, group work, learning communities, microbiology, online

Cluster 20 (6 items)	coronaviruses, educational assessment, educational facilities, educational stages, knowledge, lesson plans
Cluster 21 (5 items)	anxiety, anxiety markers, anxiety research, domestic experience, educational experiment
Cluster 22 (5 items)	context-awareness, learning engagement, mobile sensing, multimodal learning analytics, physical learning environment
Cluster 23 (5 items)	active learning, heart rate, non-self-report, self-report, student engagement
Cluster 24 (4 items)	asynchronous modes of learning, hybrid modes of learning, hyflex mode of learning, synchronous
Cluster 25 (4 items)	engineer's training, mathematical training, program learning outcomes, testing on the moodle platform
Cluster 26 (4 items)	digitization, pedagogical innovation, satisfaction assessment, training
Cluster 27 (3 items)	geographic information systems, google classroom, students' perception
Cluster 28 (3 items)	joint data reduction, location-scale model, recursive partitioning for ordinal data

There are 28 clusters that group items by groups in bibliometric analysis. By clustering items researchers can gain valuable insights into interrelated relationships and themes. The visual representation provided by VOSviewer enhances the interpretability of complex bibliometric networks.

In addition to clusters there is the output of Keyword Verification. Keyword verification allows researchers to visualize and understand relationships and trends within a particular field of study. By analyzing the co-occurrence of keywords, researchers can identify research hotspots and emerging trends within their field, as shown in Table 2 below.

Tabel 1. Keyword Verification In Distance Learning Assessment

Keywords	**Occurrences**	**Total Link Strength**
distance learning	28	131
higher education	7	43
e-learning	8	40
distance education	7	34

covid-19	7	30
assessment	5	24
pandemic	4	23
blended learning	3	17
online assessment	4	16
online education	3	15

Table 2 shows the top 10 strongly interlinked keywords to reveal significant relationships among keywords in the literature (Gorzeń-Mitka et al., 2020). This approach not only highlights the frequency of certain keywords but also illustrates how they cluster together, indicating areas of intense research activity. The keywords include distance learning (131), higher education (43), e-learning (40), distance education (34), covid-19 (30), assessment (24), pandemic (23), blended learning (17), online assessment (16), online education (15).

The relationship between keywords, provides insight into the development of research in this area (Jun, 2021). The ability to visualize these keyword relationships assists researchers in identifying gaps in the literature and potential areas for future exploration (Zuraidi et al., 2022). The meaning of the relationship between these keywords can be narrated into the following findings:

Since the emergence of the "pandemic" "COVID-19", the world of education has undergone a massive transformation, especially in terms of "distance learning". Before the pandemic, the concept of distance learning already existed, but it was more limited to open and distance learning with more traditional methods. However, with social distancing and restrictions on physical activities, the need for a flexible and remotely accessible education system is increasingly urgent. This is where "e-learning" and "online education" become the main solution for educational institutions around the world (Nandy et al., 2021). This marks a paradigm shift from traditional teaching methods to a more technology-based approach (Orozco et al., 2023).

This online-based learning, which allows interaction between teachers and learners through digital platforms, has introduced a new way of conducting "higher education". Colleges and universities that previously relied on face-to-face meetings have been forced to adapt to this new method. "Blended learning", which combines online and offline learning, has become one of the most widely used approaches to ensure a smooth teaching and learning process during the pandemic (Huang, 2020; Nandy et al., 2021). However, one of the biggest challenges in implementing online learning is "assessment". In higher education, assessment is a crucial element to measure students' understanding and skills. Along with the increasing use of online assessment, there are issues related to integrity and fairness in assessment. The online evaluation process requires the presence of technology that can ensure

data accuracy and security, and prevent cheating in exams (Appolloni et al., 2021; Souto-Romero et al., 2024).

The COVID-19 pandemic has also accelerated the application of information and communication technologies (ICT) in the education system. These information technologies have become the backbone of delivering course materials, organizing class schedules, and providing access to online learning resources. This not only expands the reach of education, but also opens up opportunities for people who were previously marginalized by geographical or socio-economic limitations. While the pandemic has accelerated the adoption of "distance education", it is undeniable that there are challenges to be faced in its long-term implementation. The quality of teaching and materials provided through online platforms must always be maintained so as not to compromise existing educational standards. In addition, equal access to technology and stable internet connection are important issues in ensuring that online learning is accessible to all (S. Ali et al., 2024; Dindar et al., 2022).

Overall, the impact of the COVID-19 pandemic on higher education and distance learning systems opens up new opportunities to develop more flexible and inclusive education methods. With the support of evolving technologies and a better understanding of how to manage online learning, the future of higher education could be more diverse and affordable. Although challenges remain, distance learning supported by information communication technology offers great potential to change the face of education globally. Research emphasizes the importance of good course design and the use of curriculum matrices to achieve desired learning outcomes (Pressley et al., 2021; Tanis, 2020). This suggests that while there are challenges in online assessment, there is also potential to enhance the student learning experience through innovations in assessment methods.

Visualization Of The Global Research Network, Including Linkages Between Keywords

Visualization of global research networks, including the interrelationships between keywords, is an important aspect of bibliometric analysis that can provide deep insights into developments and trends in various disciplines. One effective tool for performing this visualization is VOSviewer, which allows researchers to build and visualize network maps based on bibliometric data. In this context, several studies have shown how VOSviewer can be used to analyze and map research networks in the field of distance learning assessment.

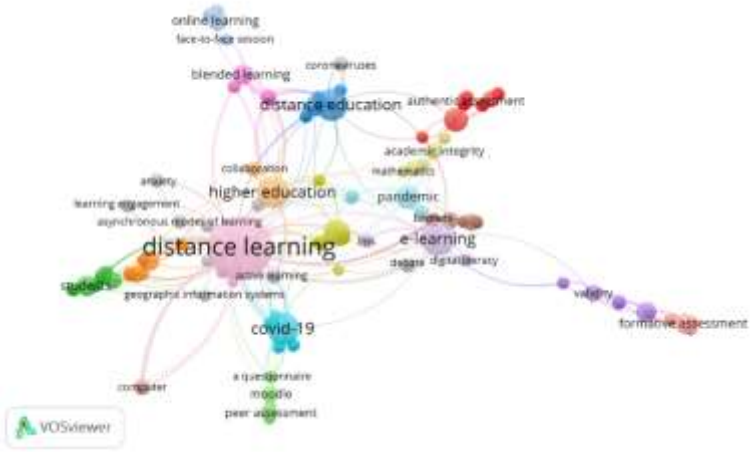

Figure 1. Linkage Between Keywords on Network Visualization

Nurhayati in her research on "Research Data Management" (RDM) used VOSviewer to explore global developments and trends in RDM research. The research included an analysis of author and subject productivity, as well as a network visualization based on keywords that showed collaboration between countries (Nurhayati & Lawanda, 2023). The results of these visualizations provide a clear picture of how keywords are related to each other and how research in this field is evolving globally. In addition, Susanto (2023) also applied VOSviewer in analyzing research trends in the water resources environment. This research shows how bibliometric visualization can be used to understand the interrelationships between keywords and author collaboration in the research. Using prism analysis and bibliometric methods, this study successfully mapped the relationship between relevant keywords, making an important contribution to the development of sustainable water resources management.

Furthermore, Wungo (2021) conducted a bibliometric analysis in the field of sustainable urban design using VOSviewer to visualize the intellectual structure and development of research in this field. This research demonstrates how VOSviewer can help in understanding research dynamics and interrelationships between keywords in the context of sustainable urban design, as well as providing insights into the productivity of scientific publications in the category. The resulting visualizations provide a comprehensive picture of research trends and collaboration among researchers. In a broader context, Budianto also used VOSviewer to map research around Musyarakah contracts in Islamic financial institutions. The research included keyword analysis generated from 310 articles, which was then visualized to show the development of research topics and subjects (Budianto, 2022). The results of this study show how VOSviewer can be used to identify trends and patterns in the existing literature, as well as provide a basis for future research.

Thus, VOSviewer proves to be a very useful tool in visualizing global research networks and interrelationships between keywords. Through various studies, it has been shown that VOSviewer not only facilitates bibliometric analysis, but also assists researchers in understanding the complex relationships

between various elements in the academic literature. Thus, the use of VOSviewer in bibliometric analysis can provide valuable insights for research development in various fields.

Identification Of Research Gaps To Direct Future Studies

Overlay visualization in VOSviewer is a powerful technique that enhances bibliometric analysis by allowing researchers to observe the temporal dynamics of keywords and their occurrence in a given research domain. This visualization method provides insight into how research topics evolve over time, highlighting the emergence of new keywords and the fading of old ones. VOSviewer overlay visualization to illustrate keyword occurrences chronologically, which reveals trends and shifts in research focus from year to year (Peng et al., 2023). By setting a threshold for keyword occurrences, this research effectively filters out high-frequency keywords, thus enhancing the visual representation of the data. The overlay visualization not only maps the frequency of these keywords, but also shows their temporal relevance, indicating areas for future research. This approach underscores the importance of overlay visualization in showing emerging themes that may require further investigation (Liu et al., 2024). By analyzing high-frequency keywords, this study illustrates how certain topics have gained prominence over time, providing a clear picture of the evolving research landscape in oncology. Such visualizations are essential for researchers aiming to understand the historical context of their field and identify gaps in the literature that can be addressed in future research (Wang et al., 2021).

Overlay visualization, to connect co-citation links and keyword occurrences, thus providing a comprehensive overview of research trends in this emerging field. The ability to visualize temporal relationships between keywords allows researchers to track the development of a particular field of study and assess its relevance within the broader context of scientific inquiry (Zhan et al., 2022). The overlay visualization in VOSviewer serves as an important tool for researchers across different disciplines, allowing them to analyze the temporal dynamics of keywords and their interconnections. Using this technique, the study. The integration of overlay visualization into bibliometric analysis not only enhances the understanding of the research landscape, but also facilitates informed decision-making for future investigations

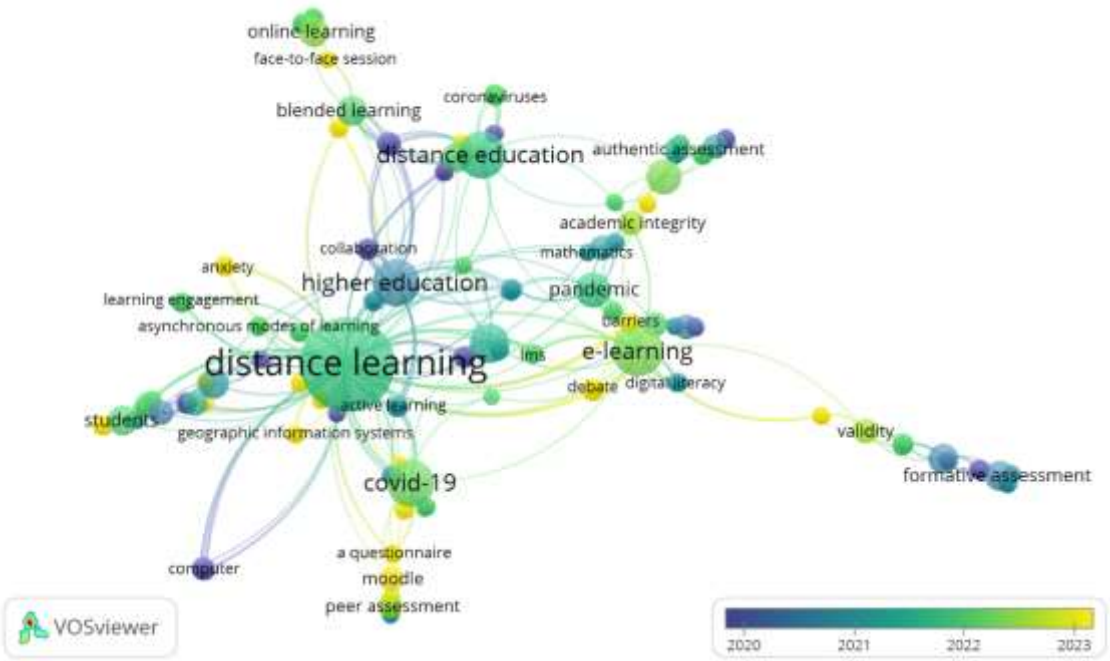

Figure 2. Linkage Between Keywords on Overlay Visualization

In the context of distance learning assessment, the identification of recent and rarely discussed keywords is crucial to understanding the dynamics and challenges faced in modern education. VOSviewer, as a bibliometric analysis tool, can be used to visualise the interrelationships between keywords relevant to this theme. Recent and rarely discussed keywords related to distance learning assessment are shown in yellow circles. These keywords include: personality psychology, design guidelines, distance teaching, network, questionnaire, practice base, moodle, incidence epidemic, educational institution, geographic information system, google classroom, student perception, social model, participatory, mental health, mental wellbeing, compassion, factors influencing distance, maths teacher, alternative assessment, barriers, anxiety research, anxiety markers, home experience, anxiety, educational experiment, assessment techniques, academic performance, management students, incidence, epidemic, educational institution, location-scale models, shared data reduction, recursive partitioning, student-instructor interaction, instructor performance, student satisfaction, course evaluation, graduate students, face-to-face sessions, questionnaire methods, educational quality assessment, disciplines, server device performance, m/m/m and m/g/m/k techniques, technical issues in distance learning, cheating, moral disengagement theory, barriers, adaptation, frustration, instructors, debate, group work, digital skills, online, learning communities, microbiology, continuous assessment and programming.

Although the focus is different, the keyword mapping approach can be applied to analyse keywords in a distance learning context, where an understanding of students' perceptions and the factors that influence their learning experience is crucial. Using VOSviewer, researchers can visualise the

relationships between keywords related to students' experiences, such as "anxiety," "academic performance," "student satisfaction," "mental wellbeing" and "frustration," to better understand the challenges students face in unconventional learning environments. VOSviewer allows for clear visualisation of the relationships between these keywords, making it easier for researchers to identify areas that require more attention in future research.

Furthermore, research by Agustina & Fithria (2023) highlighted the importance of bibliometric analysis in identifying trends. Using VOSviewer, researchers can categorise keywords based on their similarity and frequency of occurrence, thereby identifying new keywords that may emerge as educational technology develops, such as 'Google Classroom' and 'Moodle'. It is important to understand how these platforms affect the interaction between students and instructors and their impact on the quality of education.

In this context, it is also important to consider keywords related to alternative assessment techniques and measurement of learning outcomes, such as 'alternative assessment' and 'continuous assessment.' Research by Rinaldi (2022) on traveller behaviour shows how bibliometric analysis can help in understanding the development of research in a particular field. By applying the same method to distance learning assessment, researchers can identify assessment techniques that are most effective and relevant to the current learning context.

Overall, using VOSviewer to analyse the interrelationships between keywords in distance learning assessments can provide valuable insights into the trends and challenges faced in modern education. By identifying recent and rarely discussed keywords, researchers can direct their research focus to explore lesser explored areas, thus contributing to the development of better educational practices.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the analysis it can be concluded that The 10 major themes and research trends related to distance learning assessment include distance learning (131), higher education (43), e-learning (40), distance education (34), Covid-19 (30), assessment (24), pandemic (23), blended learning (17), online assessment (16), online education (15). Recent and rarely discussed keywords that the researcher recommends as new directions for future research on distance learning assessment include: personality psychology, design guidelines, remote teaching, networking, a questionnaire, practice base, moodle, incidence epidemic, educational institutions, geographic information systems, google classroom, students' perception, social model, participatory, mental health, mental wellbeing, compassion, factor influencing distance, mathematics teachers, alternative assessment, obstacles, anxiety research, anxiety markers, domestic experience, anxiety, educational experiment, assessment techniques, academic performance, management undergraduates, incidence, epidemic, educational institutions, location-scale model, joint data reduction, recursive partitioning, student-instructor interaction, instructor's performance, student satisfaction, course evaluation, postgraduate learners,

face-to-face session, questionnaire method, education quality assessment, safety disciplines, server device performance, m/m/m and m/g/m/k techniques, technical issues in remote learning, cheating, theory of moral disengagement, barriers, adaptation, frustration, faculty, debate, group work, digital skills, online, learning communities, microbiology, continuous assessment and programming.

FURTHER STUDY

This research still has limitations such as the lack of contextual analysis. Bibliometrics only analyses bibliographic relationships (such as co-occurrence), but does not delve deeper into the content or quality of distance learning assessments so further research is needed on the topic of Distance Learning Assessments, in order to refine this research and add insight for readers.

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