Research Article

Trend research mapping of differentiated instruction: A bibliometric analysis

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Differentiated instruction is an important teaching approach that adapts educational experiences to fit the varied needs and learning styles of students in the classroom. This study examines the trend of research on differentiated instruction, using a bibliometric analysis to understand the current state of research in this area. The analysis was performed using online databases such as Scopus to locate relevant research articles from 1961 to 2023. The results of the analysis revealed that 746 articles were examined, focusing on factors such as publication year, language, journal, authors, and keywords. The findings indicate a gradual increase in research on differentiated instruction, with a significant rise in the number of articles published in recent years. The majority of the research articles were written in English and authored by scholars from universities in the USA and Europe. The keywords used most frequently in the articles included differentiated instruction, inclusive education and differentiation. This study provides a comprehensive view of the research trends in differentiated instruction, underscoring the need for further research to enhance our understanding of the approach's effectiveness and its impact on student learning outcomes. Recommendations for future research in the field of differentiated instruction include the need for research on themes and concepts that are less studied in the field, such as the application of differentiated learning in online learning, and the use of technology in differentiated instruction.

Keywords: Differentiated instruction; Trend research; Bibliometric analysis

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1. Introduction

Differentiated instruction, also known as differentiated learning, is a teaching approach in which the teacher provides students with different ways to learn the same material. The development of research on differentiated instruction has been growing over time since its inception in 1961 (Tomlinson, 2001). In the early years, the concept of differentiated learning was first introduced by Carol Ann Tomlinson in the field of education. She proposed that teachers should create different paths for different students to learn the same material to meet the diverse needs of students in the classroom. She suggested that different students require different learning and teaching approaches based on their learning style, interests, and background knowledge (Tomlinson & Mctighe, 2006).

In the 1990s and 2000s, research on differentiated instruction began to focus more on specific strategies and practices that teachers could use to differentiate instruction (Tomlinson & Imbeau, 2010). This included using flexible grouping, providing multiple ways of representation, and using ongoing assessment to inform instruction. Researchers also began to investigate the effectiveness of differentiated instruction in improving student achievement. In recent years, research on differentiated instruction continues to focus on specific strategies and practices, but has also expanded to include the use of technology in differentiated instruction (Goddard & Kim, 2018). This includes the use of online resources and tools, such as interactive whiteboards and educational software, to support differentiated instruction (Smets & Struyven, 2020). Additionally, research has begun to investigate the use of differentiated instruction in specific content areas, such as math and science, and in specific populations, such as English language learners and students with disabilities. Overall, the development of research on differentiated instruction has evolved from a focus on the theoretical foundations of the approach to a focus on specific strategies and practices that teachers can use in the classroom (Tomlinson & Moon, 2013). By continuing to use technology and focusing on specific content areas and populations, research on differentiated instruction will continue to evolve and inform educational practice in the future.

Differentiated Instruction (DI) is an essential topic to research since it is an effective method for meeting students' various learning demands (Lavrijsen et al., 2021). DI enables more flexible and effective learning for students with diverse learning styles, needs, talents, and backgrounds (Kohnke, 2022). DI research can help educators build more effective and efficient learning practices to accommodate the diverse learning demands of their pupils (Zólyomi, 2022). DI can also aid improve learning results by enhancing student motivation and participation (Goddard & Kim, 2018). Furthermore, DI has the ability to improve inclusivity and equity in education. DI can help to provide more equal and equitable access to education by taking into account the individual variations of students (Darrow, 2015). Overall, DI research is vital for supporting educators in establishing more effective and efficient learning ways, as well as enhancing educational equity and inclusiveness. By expanding our understanding of DI, we can increase educational quality and provide more opportunity for children to realize their full learning potential.

Research has shown that differentiated instruction has a positive impact on student learning, leading to increased student engagement, improved academic achievement, and greater student satisfaction (Lin et al., 2021). However, despite its potential benefits, implementing differentiated instruction in the classroom can be challenging and requires a lot of planning and preparation (Hernandez et al., 2021). Therefore, it is important to understand the concept of differentiated instruction and the research that supports it in order to effectively implement it in the classroom.

One way to understand the development of research from differentiated instruction is to use bibliometric analysis. Bibliometric analysis is very suitable for use in mapping research on Differentiated Instruction because it can provide important information for researchers and educational practitioners in understanding research developments in this field. By using bibliometric analysis, researchers can identify the latest research trends, leading authors and journals, developing research topics, and the impact and influence of research on the development of better education (Zhang et al., 2021). Through bibliometric analysis you can also see how much research has been done in the field of Differentiated Instruction, and can identify areas that still need more research (Kalia et al., 2022). In addition, bibliometric analysis can also help in mapping the relationship between research topics, authors, and leading journals in this field (Aria & Cuccurullo, 2017). This can provide valuable insights into the latest research trends and topics, as well as assist in identifying possible research collaborations and partnerships that can have a positive impact on educational development (Markoulli et al., 2017). Thus, bibliometric analysis can help researchers and educational practitioners to develop more effective and efficient research and development priorities (Pham-Duc et al., 2021).

This study will use bibliometric analysis to investigate literature on differentiated instruction, including the number of publications, journals that publish them, and authors and institutions that

are most active in this field. Additionally, this research will use text mining techniques to analyze the content of articles and identify key themes, concepts, and research questions (Yang et al., 2022). This will allow us to understand the evolution of this field over time, including the emergence of new research themes, popularity of certain topics, and impact of key scientists and journals (Phoong et al., 2022). The study will also investigate the international distribution of publications on differentiated instruction, including the countries where research is conducted and published. This will provide insight into the global reach of the field, and help identify geographical or linguistic differences in research (Mukherjee et al., 2022). Furthermore, this research will analyze patterns of collaboration between authors and institutions in the field of teaching and learning. This includes identifying the most productive institutions, authors, and countries, as well as the networks of collaboration among them. The research will also assess the impact of research on differentiated instruction by analyzing the number of citations, h-index, and other scientific impact metrics. This will help identify the most influential articles, authors, and journals in the field, and understand the scope and impact of research on differentiated instruction. Overall, this research will provide a comprehensive overview of the current state of differentiated instruction, highlighting key themes, journals, and scholars in the field, and identifying areas for future research. The findings of this research will be useful for educators, researchers, and policy makers as they work to improve educational practice and support student learning.

Therefore, this study aims to conduct a bibliometric analysis of trend research mapping on differentiated instruction to understand the current state of research in this field. This research is considered important enough to conduct initial studies on research subjects, avoid similar research, and help researchers determine roadmaps for further research. So this research question is:

RQ 1) What is the distribution of publications by year, country, affiliation, source, most cited articles, and most prolific author in differentiated instruction?

RQ 2) What are the trending and relevant topics for future research differentiated instruction?

2. Method

2.1. Research Method

Bibliometric analysis methods allow researchers to conduct studies on collections of aggregated bibliographic data, including academic journals and related citations. This method utilizes bibliometric correlation analysis to highlight current research directions, as well as cross-examination of article keywords and co-citations to demonstrate topical structure and intellectual underpinnings for the respective field (Man et al., 2019). This method is used in this research, and the results demonstrate how topics are organized and related to each other before the elements are visually mapped out. The bibliometric method includes steps such as identifying research queries, selecting suitable methods, arranging and sorting relevant data, washing and analyzing the data, and displaying data and interpreting the results (Seetharam et al., 2018).

2.2. Data Collection

The metadata was obtained from the Scopus Database and was used to accumulate publications concerning differentiated instruction from 1961 to 2023 by using search term "Differentiated Instruction". This metadata was retrieved in January 2023, and to avoid search errors caused by database updates, data investigations were conducted in a single day, and no search limits were imposed. The collected data was then filtered based on the year of publication, document type, subject field, and document source type. The processed results of the document filters from the Scopus database are shown below.

<div align="center">TITLE-ABS-KEY ("Differentiated Instruction")</div>

After filtering the database, the results are as shown in the following figure.

Figure 1

The process of retrieving metadata in the Scopus database
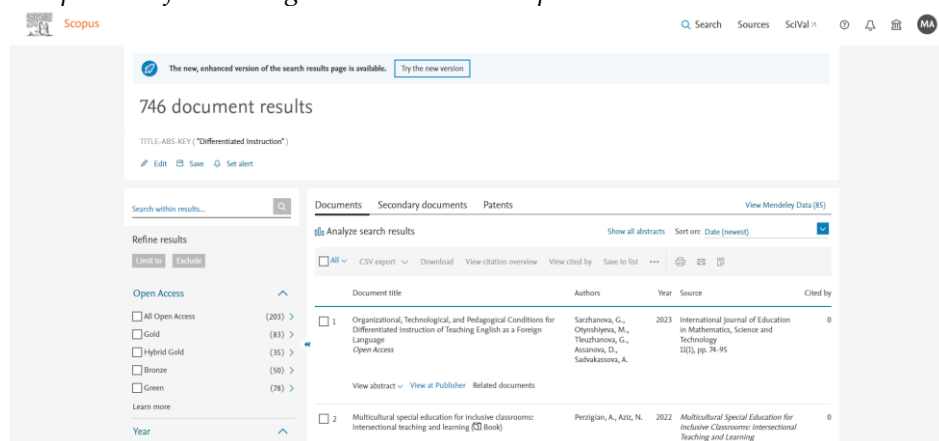
After the keywords to find data from Scopus are applied, the entire metadata is downloaded in comma summative value (.csv) format.

2.3. Data Coding and Analysis

After obtaining metadata from the Scopus database, the next step is to perform metadata analysis using R Studio software with the Bibliometrix package. To install the bibliometrix package, the code "install.packages(bibliometrix)" must be used for the first time. After the package is installed, it can be called using the code "library(bibliometrix)", followed by the code "biblioshiny()" to open the bibliometric analysis program in a browser window. Scopus metadata can be imported in the "Loading Data" section. The results of the analysis will display visualizations of published articles, most cited articles, most prolific authors, most used keywords, and the evolution of research themes. The end result is a descriptive analysis used to examine and interpret the findings.

3. Results

3.1. Distribution of Publications by Year, Country, Affiliation, Source, Most Cited Articles, and Most Prolific Author in Differentiated Instruction

3.1.1. Main information

After the metadata has been exported to biblioshiny, the initial appearance of this software is the main information of all articles that have been exported and are ready to be analyzed. The main information regarding the documents to be analyzed using a bibliometric is presented in Figure 2.
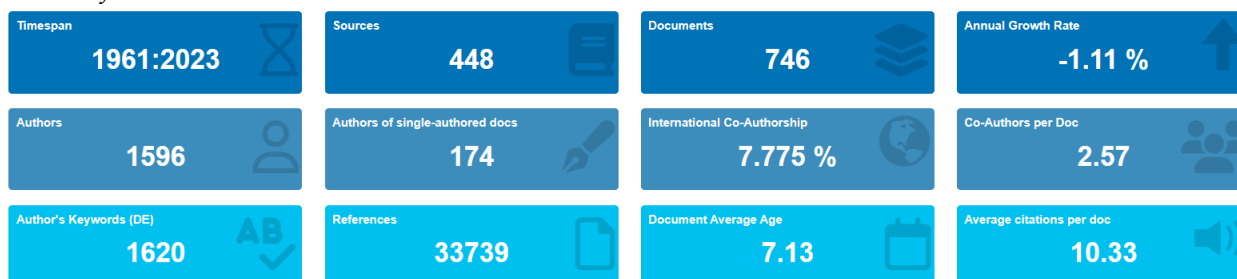
Figure 2

Main information

Figure 2 shows that there are 746 documents that were subject to bibliometric analysis of documents published from 1961 to 2023, sourced from 448 Scopus indexed journals, proceedings, and books. The average publication growth per year reaches -1.11%. There are 1596 authors, of which 174 are document authors with one author. The percentage of international co-authorship is 7.775% with 2.57 Co-authors per Document. There are also 1620 keywords and 33739 references

related to human resource management. Additionally, these documents have an average of 10.33 citations per document

3.1.2. Distribution of articles by years

This study presents the distribution of publications each year on Scopus. Data distribution starts with the year the article was first published until the article is ready to be published. The results of the distribution of the number of article publications each year are presented in Figure 3.

Figure 3
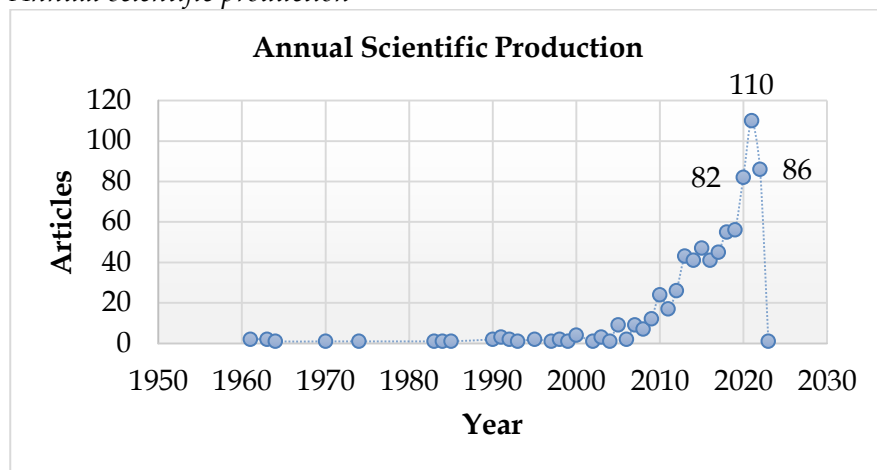*Annual scientific production*

Figure 3 provides interesting information about research trends in differentiated learning. The data shows that the number of articles related to this topic has continued to increase over time, with a significant spike in 2020. The peak occurred in 2022, when 110 articles related to this topic were published. This indicates that research related to differentiated learning will continue to be a relevant topic for investigation in the future.

3.1.3. Distribution of articles by country

Many countries conduct research in the field of differentiated instruction every year, but if you look at the productivity of these countries, the top 10 countries are the countries of origin. When research published by Scopus is displayed or presented according to the country conducting the research, the results are obtained in the diagram in Figure 4.
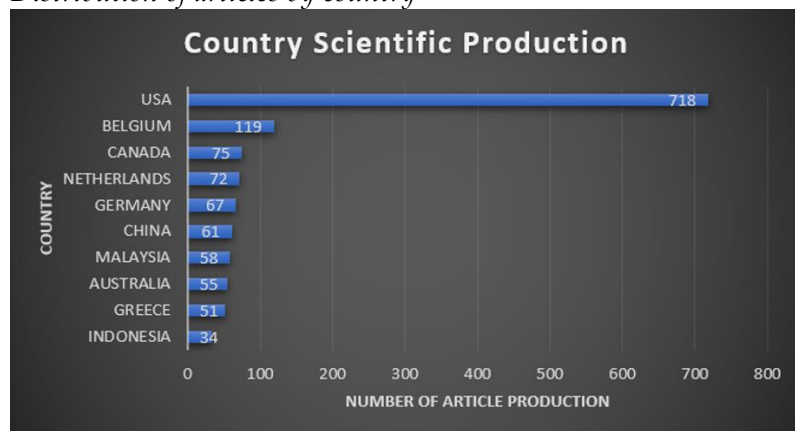
Figure 4
Distribution of articles by country

Figure 4 provides information on the most productive countries in producing articles on differentiated learning. The data shows that the USA is the most productive, with 718 articles related to this topic. Belgium is in the second position with 119 articles, followed by Canada, the

Netherlands, and Germany as the top five most productive countries. This indicates that the USA has a very dominant position in research on differentiated learning, compared to other countries listed in Figure 4. The USA's position as the most productive country may be influenced by many factors, such as a high number of universities and research institutions, the availability of funding for research, and the early adoption of differentiated learning approaches in this country.

3.1.4. Most productive affiliate

The following presents data related to the most productive affiliations for the differentiated instruction theme. The results of the bibliometric analysis can be seen in Figure 5.

Figure 5
The Most Productive Affiliates
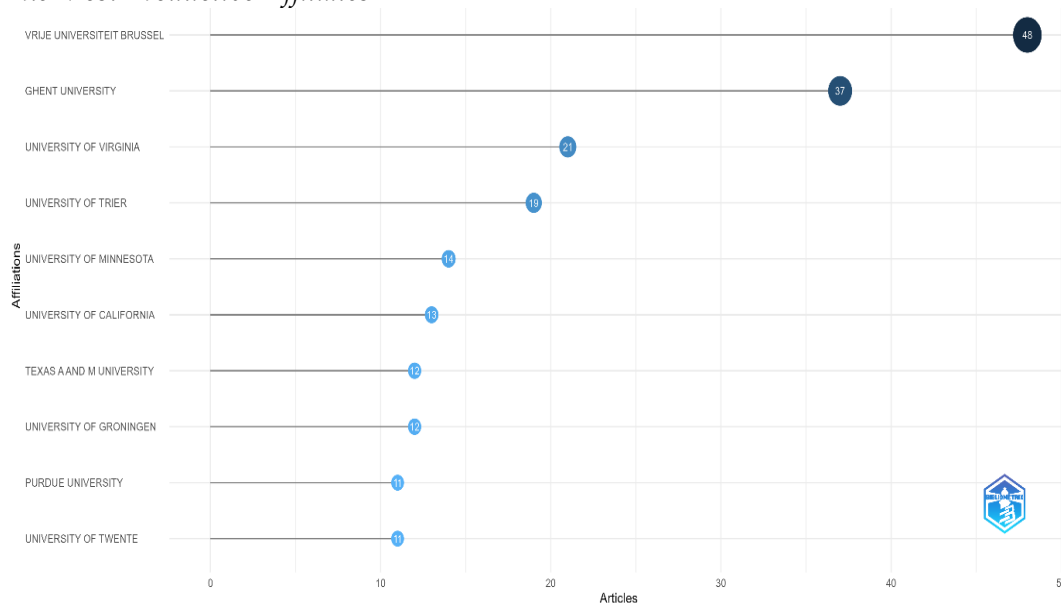
According to Figure 5, Vrije Universiteit Brussel is the affiliate that publishes the most articles in the field of differentiated instruction. This affiliate has published more than 48 articles, which is far more than any other affiliate. This indicates that Vrije Universiteit Brussel has many active researchers in this field and has made a significant contribution to advancing knowledge about differentiated instruction. In addition to Ghent University also appears to be quite active in publishing articles in this field. This university has published more than 37 articles related to differentiated instruction, making it the second-ranked affiliate in terms of the most publications. In addition to these two affiliates, there are three other affiliates that are also in the top five affiliates with the most publications in the field of differentiated instruction, namely University of Viginia, University of Trier, and the University of Minnesotta. This indicates that the field of differentiated instruction has attracted the interest of many researchers from various universities around the world.

This data can help researchers and academics understand the latest developments in the field of differentiated instruction and find research partners or collaborators in relevant universities. In addition, this data also provides information about how research and thinking in the field of differentiated instruction are taking place around the world. By knowing the most active affiliates in publishing in this field, researchers can determine the appropriate research direction to enrich knowledge in the field of differentiated instruction.

3.1.5. Most productive sources (articles and citations)

The citation analysis begins with the 10 sources with the highest publication according to the subject of Scopus indexed differentiated instruction. The data is presented in Table 1.

Table 1
The most productive sources

Source	Articles	Citations	h-index
International Journal of Inclusive Education	16	204	6
ASEE Annual Conference and Exposition, Conference Proceedings	12	0	1
Teaching and Teacher Education	12	471	8
Journal of Advanced Academics	11	86	7
Journal for the Education of the Gifted	9	292	5
Cogent Education	8	15	3
International Journal of Instruction	7	29	6
Kappa Delta Pi Record	7	24	2
Teachers and Teaching: Theory and Practice	7	45	5
Advances in Intelligent Systems and Computing	6	1	2

Table 1 provides information on the most productive journals and publication sources in terms of publications and citations related to differentiated learning. From the table, "International Journal of Inclusive Education" is the most productive publication with 16 articles and 204 citations. This is followed by "ASEE Annual Conference and Exposition, Conference Proceedings" with 12 publications but no citations. Although "Teaching and Teacher Education" has the fewest number of articles at 12, it has the highest number of recognized sources with 471 citations, indicating that the quality and impact of articles in this journal are very good. Table 1 also provides important information about the most productive and influential publication sources in the field of differentiated learning. Additionally, the information from the table tells us that the higher the number of citations of a journal or source, the higher its h-index value. This indicates that journals or sources with high citations have a significant impact in the field of differentiated instruction and are widely recognized by researchers in the field of differentiated instruction.

3.1.6. Articles with the most citations

The following presents the 10 most cited articles obtained by various sources and authors. Table 2 shows the results of the bibliometric analysis.

Table 2 shows information about the authors and their highest number of citations tracked by Scopus. Based on the data in Table 2, the article of Davies et al. (2013) has received the highest number of citations (512) among all articles on the topic of differentiated instruction. This article is followed by articles written by Valli and Buese (2007), Zhu et al. (2016), Reis et al. (2011), and Dixon et al. (2014), which are among the five most cited articles on the topic. The fact that Davies et al. (2013) is the most cited author indicating that his research has had a significant impact on the field of differentiated instruction. However, it should be noted that a high number of citations does not always indicate research quality, as there are other factors that influence it, such as topic popularity or research availability. The presence of other authors on the list of the most cited articles in human resource management also shows that their research has made significant contributions to the field. Including authors from different countries, such as China (Zhu et al., 2016) and the USA (Dixon et al., 2014), also highlights the global relevance of differentiated instruction as a research topic. Overall, the data presented in Table 2 provides valuable information for researchers interested in differentiated instruction, as it can help them identify key authors and articles in the field. In addition, it can provide insights into research impact in the field and future research directions.

3.1.7 The most prolific author

In the following, data is presented regarding the most productive authors for the differentiated instruction theme. The results of the bibliometric analysis can be seen in Table 3.

Table 2
Top 10-Most Articles Citations

No	Authors	doi	Year	Journal	Total Citations
1	Davies et. al	10.1007/s11423-013-9305-6	2013	Educational Technology Research and Development	512
2	Valli and Buese	10.3102/0002831207306859	2007	American Educational Research Journal	354
3	Zhu et. al	10.1186/s40561-016-0026-2	2016	Smart Learning Environments	272
4	Reis et.al	10.3102/0002831210382891	2011	American Educational Research Journal	142
5	Dixon et. al	10.1177/0162353214529042	2014	Journal for the Education of the Gifted	107
6	Boelens et. al	10.1016/j.compedu.2018.02.009	2018	Computers & Education	105
7	Vaughn et. al	10.1177/001440299806400205	1998	Exceptional Children	105
8	De Neve et. al	10.1016/j.tate.2014.12.003	2015	Teaching and Teacher Education	99
9	Wertheim and Leyser	10.1080/0022067020598791	2002	The Journal of Educational Research	92
10	Suprayogi et. al	10.1016/j.tate.2017.06.020	2017	Teaching and Teacher Education	89

Table 3
The most productive authors

| No	Authors	Affiliation	Country	Articles	Articles Fractionalized
1	Katrien Struyven	Vrije Universiteit Brussel	Belgium	15	4.58
2	Marcela Pozas	Humboldt-Universität zu Berlin	Germany	10	3.31
3	Esther Gheyssens	Vrije Universiteit Brussel	Belgium	8	1.91
4	Verena Letzel-Alt	University of Trier	Germany	8	2.67
5	Júlia Griful-Freixenet	Vrije Universiteit Brussel	Belgium	7	1.74
6	Ruben Vanderlinde	Department of Educational Studies, Ghent University, Ghent	Belgium	7	1.61
7	Wendelien Vantieghem	Centre for Diversity and Learning, Ghent University, Gent	Belgium	7	1.66
8	Els Consuegra	Department of Teacher Education, Vrije Universiteit Brussel	Belgium	6	1.53
9	John Marshall	University of Southern Maine	USA	6	4.50
10	Carol Ann Tomlinson	University of Virginia's School	USA	6	4.00

Table 3 shows that Katrien Struyven from Vrije Universiteit Brussel in Belgium is the most productive author with 15 articles on differentiated instruction. Marcela Pozas from the University of Trier in Germany ranked second with 10 articles. From the data, it appears that Belgium has a significant contribution in writing articles on differentiated instruction. It is important to note that author productivity does not always reflect the quality of their writing. However, the fact that Katrien Struyven has written 15 articles on differentiated instruction indicates that this topic is the focus of their research. This may be an indication that differentiated instruction is an important topic in the context of education in Belgium. In addition, the results from Table 3 can also provide useful information for readers who want to conduct research on differentiated instruction. In this case, they can refer to the articles written by Katrien Struyven and Marcela Pozas as initial reference sources.

3.2. Trending and Relevant Topics for Future Research Differentiated Instruction

3.2.1. Trending topics

In the following, data is presented regarding trending topics for the differentiated instruction theme. Figure 6 depicts the findings of the bibliometric analysis.

Figure 6
Trend Topics
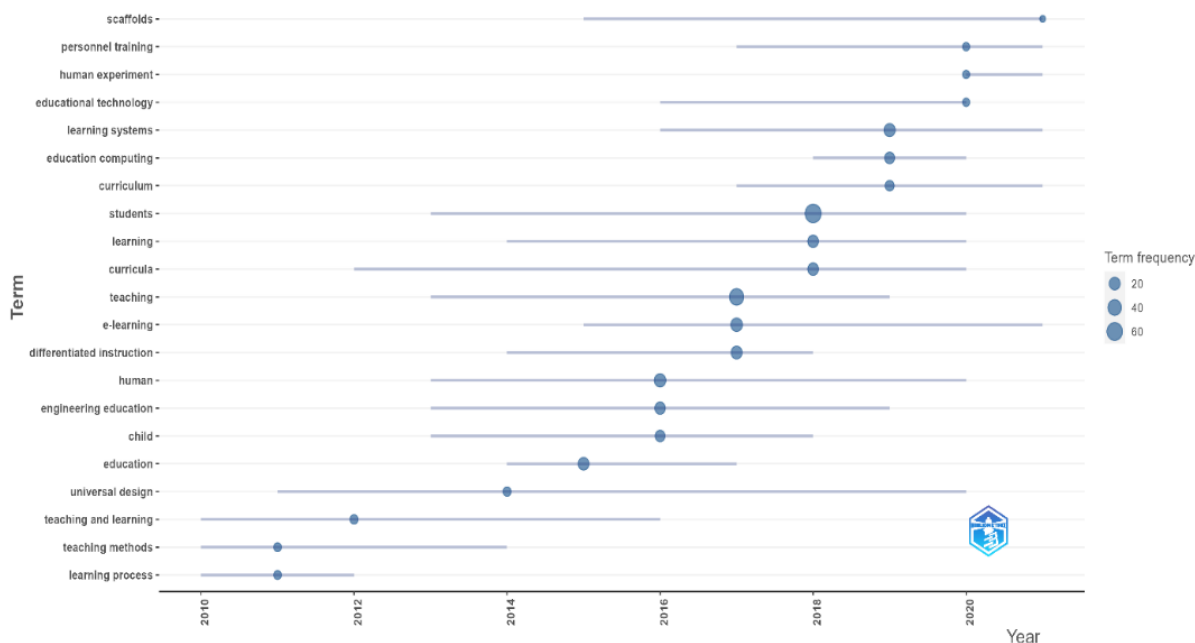
Based on Figure 6, there are several trending topics in the field of education from 2010 to 2022, and these topics can be grouped into several themes or focus areas. The first theme is Technology, which includes topics such as Technology Integration and Universal Design for Learning. These two topics demonstrate the importance of integrating technology and using universal design in education. The second theme is Inclusive Education, which includes topics such as Inclusion, Disabilities, and Special Education. This highlights the importance of inclusive education for students with special needs and the need to develop inclusive educational programs. The third theme is Learning and Teaching, which includes several topics such as Self-efficacy, Formative Assessment, Differentiated Instruction, Diversity, Differentiation, Learning Styles, Gifted, and Curriculum Mathematics, Professional Development, Early Childhood, Teacher Education, and Middle School. This theme emphasizes the importance of developing diverse and effective teaching and learning methods, as well as the need to develop educational programs for various levels and types of students. The fourth theme is Literacy, which includes topics such as Literacy and Reading. This highlights the importance of reading, writing, and speaking in education.

Additionally, from Figure 6, the topic of "Differentiated Instruction" is the most trending topic, with 300 articles published from 2016 to 2021 and its peak occurring in 2020. This indicates that this topic is very important and attracts the attention of many researchers. There are various possible explanations for why the term "Differentiated Instruction" has grown in popularity over the years. One probable explanation is the greater emphasis on personalized learning, as well as the understanding that not all kids learn in the same way or at the same rate. Another probable cause is the increasing diversity of student populations, which may necessitate more flexible and tailored methods from teachers to satisfy the requirements of all pupils. Furthermore, technological advancements and the availability of digital tools have made it easier for teachers to differentiate instruction in their classes. Furthermore, the topic of "Gifted" is also a long-term trending topic, starting from 2011 to 2021 with its highest trend in 2014. This shows the importance of research and development of educational programs for students who are gifted in various fields.

Topics included in the research trend in the field of differentiated instruction have developed and evolved every year. Figure 7 will show the evolution of changes in research trends over the past 62 years related to differentiated instruction from (1961-2018) to (2019-2023). The evolution of research themes according to subjects is outlined as follows.

Figure 7
Thematic Evolution

According to Figure 7, in 1961 to 2018, four main themes emerged as trending, including scaffolds, customization services, human, and students. These themes reflect the growing interest in creating support structures for students and customizing education to fit their unique needs. However, from 2019 to 2023, a new trend emerged with five main themes, including learning style, adaptive systems, students, human, and artificial intelligence. This indicates a shift in focus towards understanding how students learn and how technology can adapt to their needs.

The evolution of the themes from scaffolds and customization services to adaptive systems highlights the increasing importance of technology in education. It also highlights the growing demand for personalized learning experiences that cater to individual student needs. The emergence of artificial intelligence as a trending theme in recent years further emphasizes the integration of technology in education. This development has the potential to revolutionize the way students learn and make education more accessible to all. However, despite the increasing role of technology, human presence remains significant in education. The theme of human persists as an essential component in the learning process, highlighting the importance of teacher-student interaction and social-emotional learning.

Overall, the trends in educational research indicate a shift towards personalized, adaptive learning experiences that cater to individual student needs, enabled by the integration of technology. However, it is important to balance the role of technology with the human presence in education to create a holistic learning experience for students.

3.2.2. Relevant topics for future research

The following presents data related to relevant topics for future research on the differentiated instruction theme. The results of the bibliometric analysis can be seen in Figure 8.
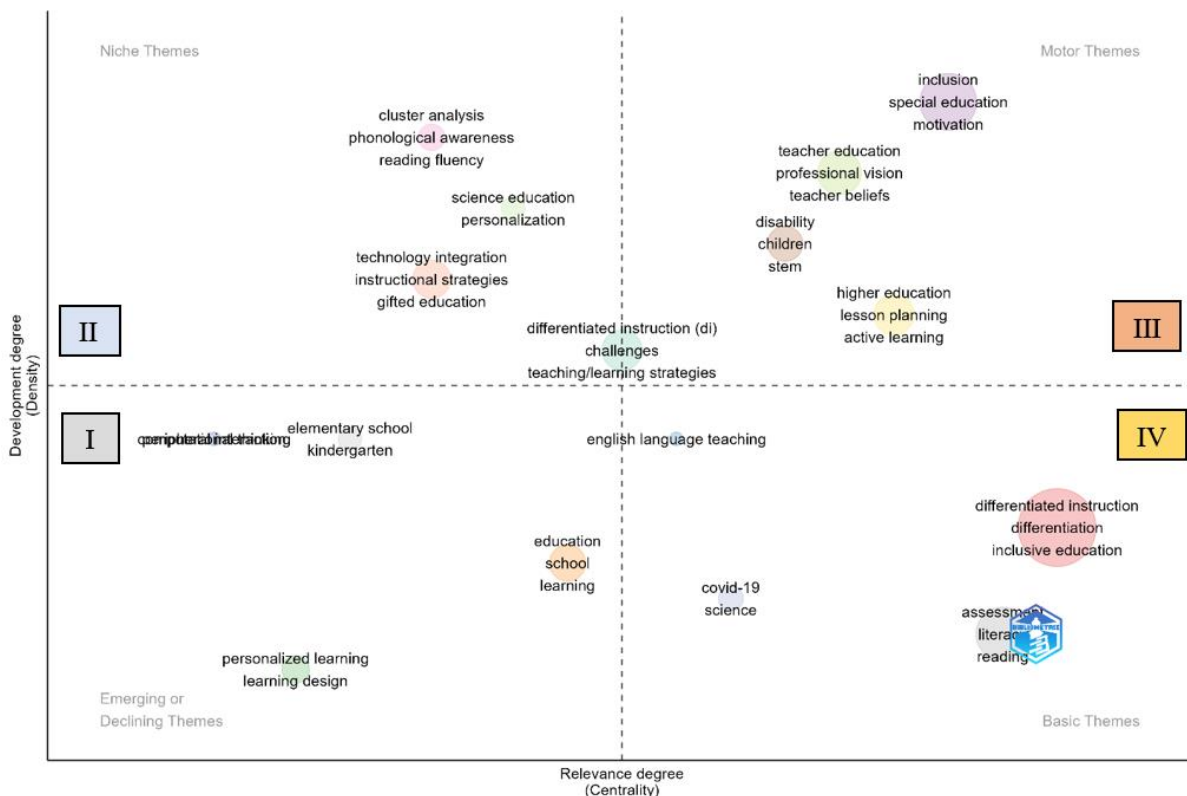
Figure 8
Thematic Map

Figure 8 provides information on the categorization of relevant topics for research on differentiated instruction into four quadrants based on current research trends. The first quadrant, emerging or declining themes, includes topics that are currently developing or declining in research trends, such as elementary school, kindergarten, education school, learning, personalized learning, and learning design. The second quadrant, niche themes, includes topics that are still of concern in research, such as cluster analysis, phonological awareness, reading fluency, science education, personalization, technology integration, instructional strategies, and gifted education. The third quadrant, motor themes, includes topics that are the focus of research, such as inclusion, special education, motivation, teacher education, professional vision, teacher beliefs, disability, children, STEM, higher education, lesson planning, and active learning. The fourth quadrant, basic themes, includes topics that are well-established and relevant in the context of education, such as English language teaching, differentiated instruction, differentiation, inclusive education, COVID-19, science, assessment, literacy, and reading.

In addition, there is one topic that falls between the second and third quadrants, namely differentiated instruction, challenges, teaching/learning strategies. This indicates that the topic of differentiated instruction is still a major focus of research and contributes to the development of effective learning and teaching strategies. In conclusion, Figure 8 provides valuable information

for researchers to choose research topics related to differentiated instruction that are in line with current research trends and contribute to the development of better education.

In bibliometric analysis, there is a method used to identify and analyze the conceptual structure of scientific literature, which is called a conceptual structure map. The purpose of a conceptual structure map is to help understand the relationships between related concepts and how these concepts develop in the scientific literature. This method involves mapping keywords (keyword mapping) and cluster analysis (cluster analysis) of scientific documents in the relevant database. This process involves several steps, including identifying keywords that are most relevant to a particular topic, creating a co-occurrence matrix to calculate the relationships between keywords, and creating a conceptual map to show the relationships between interrelated concepts. In bibliometric analysis, a conceptual structure map can provide an overview of publication patterns and the development of concepts in scientific literature. This can help researchers and professionals understand research trends in a particular field, as well as assist them in developing new research hypotheses or identifying research gaps that need further study.

Figure 9

The Conceptual Structure Map of the Most Frequent Author's Keywords in Differentiated Image Segmentation Publications
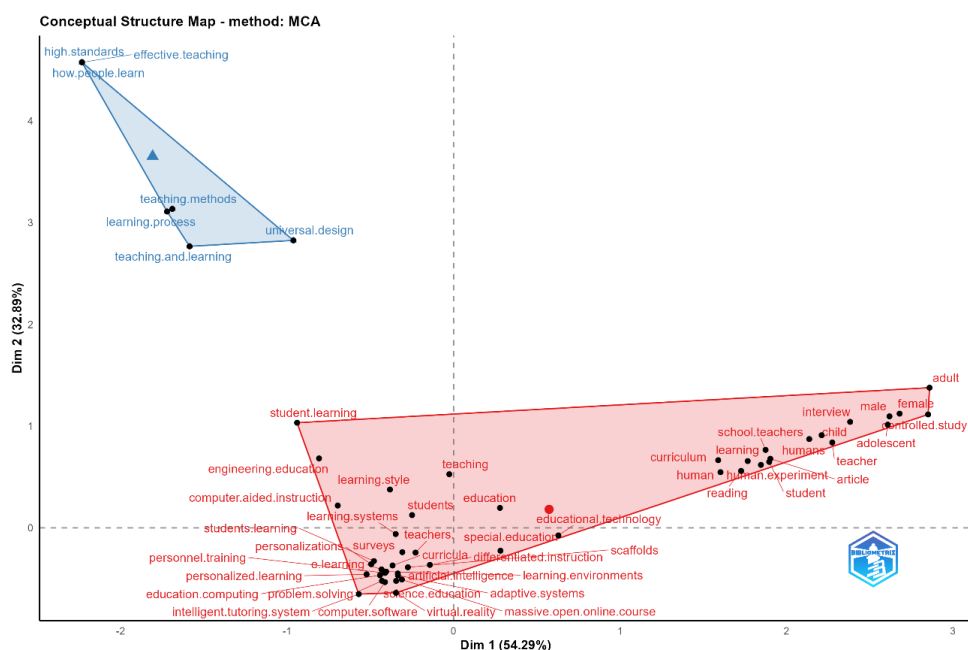
As shown in Figure 9. There are two map dimensions representing the average position of publications included in each keyword, and the center point of the map represents the center of the differentiated instruction segmentation research field. It can be easily seen from the conceptual structure map that segmentation differentiated instruction publications can be divided into two main groups. The red cluster contains most of the top keywords, while the blue cluster contains the remaining three keywords. The publications in this group contain detailed discussions of the various types of methods for differentiated instruction. The width of the shape formed means the distance between keywords or clusters in Figure 9. Each cluster color represents a partition, and keywords connected by high connection lines often have different segmentation methods, which usually appear in various publications.

4. Discussion

4.1. Distribution of Publications

Bibliometric analysis on differentiated instruction has provided important insights into the current state of the field. One key finding is that the field is active, with a stable increase in publications

over the last decade. This indicates a growing interest in the topic of differentiated instruction among researchers, educators, and policy makers. Another key finding is that the field is interdisciplinary, with connections to fields such as education, psychology, and sociology. This highlights the complexity of the concept of differentiated instruction, and the need for a multidisciplinary approach to understand and apply it. The distribution of international publications shows a strong presence of research in the USA and Europe, with less presence in other regions of the world. This finding suggests that there may be a need to increase the representation of research from regions outside the USA and Europe to gain a more comprehensive understanding of the field. The impact assessment of research on differentiated instruction shows that the field is well-cited, with several influential articles, authors, and journals. This indicates that research on differentiated instruction has a significant impact in the field and contributes to the development of new knowledge and understanding.

4.2. Trending and Relevant Topics for Future Research

In the analysis of trending topics, one topic that has become a trend in recent years is "Differentiated Instruction." Differentiated Instruction is a teaching and learning approach that takes into account individual differences among students, including differences in learning speed, interests, and learning styles (Wu, 2017). The goal of this approach is to create an inclusive and effective learning environment that allows all students to reach their full potential (Ziernwald et al., 2022). In Differentiated Instruction, teachers are expected to provide various types of materials, resources, and learning experiences that are tailored to the needs of the students (Uysal and Doğan 2021). For example, teachers can provide reading or task options, provide extra assistance to students who need it, or provide alternative projects for students who need additional challenges. This approach emphasizes the importance of understanding the differences among students and providing the necessary support to enable them to learn in the most effective way (Aldaej, 2016). Therefore, Differentiated Instruction can help teachers create more personalized and relevant learning experiences for students, which in turn can improve learning motivation and academic achievement (Brigandi et al., 2019). In the context of trends in the field of education, Differentiated Instruction demonstrates the importance of accommodating individual differences among students in teaching and learning (Stollman et al., 2021). It also shows that teachers must consider various learning methods and strategies to meet the diverse needs of students, including the use of technology to support learning.

Based on the analysis of relevant topics for future research, these topics are divided into 4 quadrants. Quadrant 1 is called emerging or declining themes, quadrant 2 is called niche themes, quadrant 3 is called motor themes, and quadrant 4 is called basic themes. Emerging or declining themes, niche themes, motor themes, and basic themes are categories used in bibliometric analysis to classify research topics based on their level of importance and relevance within a particular field (Rejeb et al., 2022). Emerging or declining themes refer to topics that are either becoming more important or losing their significance in the field. These topics may be new or relatively unexplored, or they may be topics that were previously important but are now losing relevance (López-Duarte et al., 2020). Niche themes, on the other hand, are topics that are highly specific and may not be of broad interest to the entire field. These topics may be highly specialized, focused on a particular industry or sector, or relevant only to a specific geographic region (Kholidah et al., 2022). Motor themes refer to topics that are highly influential and have a significant impact on the field. These topics may be well-established and highly researched, and they are likely to have a broad impact across the entire field (Li et al., 2022). Finally, basic themes refer to the fundamental concepts and principles that underpin the field. These topics are likely to be widely researched and highly relevant to the entire field, and they may be viewed as essential knowledge for researchers working in the area (Abouzid et al., 2021). By categorizing research topics into these four categories, bibliometric analysis can provide valuable insights into the current state of research in a

particular field and can help researchers identify which topics are most important and relevant to their work.

In choosing research topics in the field of differentiated instruction in the future, the chosen quadrant category depends on the research objectives and the researcher's interests. If the goal is to research a topic that is emerging, then topics in the Emerging or Declining Themes category can be chosen. However, if the focus is on a more specific topic, then topics in the Niche Themes category can be chosen. Meanwhile, topics in the Basic Themes category are more suitable if one wants to study topics that have been tested and proven important in differentiated instruction practice.

For research that focuses on emerging or declining topics, the Emerging or Declining Themes category can be the appropriate choice. Example, of the topic fall into this category are elementary school, kindergarten, education school, learning, personalized learning, dan learning design. Meanwhile, for research that wants to focus on a relatively specific topic that has not been extensively researched, the Niche Themes category can be chosen. Example, of the topic fall into this category are phonological awareness, reading fluency, science education, personalization, technology integration, instructional strategies, dan gifted education. If the research wants to focus more on a specific industry or based on target audiences, the Motor Themes category can be the appropriate choice. Example, of the topic fall into this category are inclusion, special education, motivation, teacher education, professional vision, teacher beliefs, disability, children, stem, higher education, lesson planning, dan active learning. Finally, for research that wants to focus on more general and fundamental topics in digital marketing, the Basic Themes category can be chosen. Examples of topics that fall into this category are English language teaching, differentiated instruction, differentiation, inclusive education, covid-19, science, assessment, literacy, dan reading, which can be the focus of research to understand how differentiated instruction can be implemented effectively and efficiently.

The practical implications of these research findings are that they can be used to develop professional development programs for teachers to improve their practices in education and in-class teaching. These findings can also be used as considerations by policymakers in the field of education to ensure that differentiated teaching is effectively implemented and supported. In conclusion, the bibliometric analysis of differentiated instruction has provided a comprehensive overview of the current state of the field, its evolution over time, its international scope, and its impact on the scholarly and educational practice communities. However, it is important to note that this analysis is only a part of research on differentiated instruction, and further research is needed to gain a more comprehensive understanding of the field.

5. Conclusions

The bibliometric analysis of the literature on differentiated instruction has provided a comprehensive overview of the current state of the field. The analysis shows that the field is active, with a stable increase in publications over the last decade. The most productive journals, authors, and institutions have been identified, as well as the current main themes and concepts being researched. The distribution of international publications shows a strong presence of research in the USA and Europe, with less presence in other regions of the world. Temporal trend analysis shows that the field has developed over time, with new research themes emerging and certain topics becoming more popular. The assessment of research impact on differentiated instruction shows that the field is well-cited, with a few influential articles, authors, and journals. However, there are limitations to this study, namely only summarizing information based on the Scopus database. So that the interpretation is limited to the findings contained in Scopus indexed journals.

Recommendations for future research in the field of differentiated instruction include the need for research on themes and concepts that are less studied in the field, such as the application of differentiated learning in online learning, and the use of technology in differentiated instruction. Research can also focus on understanding the implementation of differentiated instruction in different regions and cultures. Understanding the challenges faced in implementing differentiated

instruction in different regions can provide valuable insights for educators and policymakers in the field of education. In addition, future research should explore more diverse databases, such as Web of Science (WoS/WoK), Dimensions, Lens.org, PubMed, and the Cochrane Library, and link metadata from multiple database providers to improve the accuracy of results and identify trends in differentiated instruction research.

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Note: (* marked references are the top-10-most cited articles presented in Table 2)

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