Migration Letters

Volume: 21, No: 2, pp. 625-641

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Trend Research and The Role of Technology Multiple Intelligences in Higher Education Based on Scopus Data: A Systematic Literature Review

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Abstract

This systematic literature review is to investigate the evolving role of technology in the integration of Multiple Intelligences theory in higher education as well as utilize Scopus data for comprehensive analysis of scientific publications. The main objective of the study is to provide an in-depth exploration of the emerging trends and implications of the intersection of Multiple Intelligences theory and educational technology in higher education. This review meticulously collects and evaluates a wide array of academic sources, including research articles, and conference papers obtained from the Scopus database. A total of 156 different articles were screened and 42 articles that met the inclusion criteria were found to be analyzed. Findings from this systematic literature review reveal a dynamic and ever-changing educational environment, characterized by innovative approaches to personalization, adaptive technologies, and inclusive teaching practices. These trends underscore the increasing recognition of individual cognitive diversity and the potential of technology to enhance the accommodation of these unique abilities in higher education. As the influence of technology continues to shape higher education, this review offers valuable resources for educators, instructional designers, and policymakers. It provides insight into the current state of integrating the theory of Multiple Intelligences with technology in higher education, ultimately facilitating a more inclusive and effective learning environment.

Keywords: *Technology; Multiple Intelligences; Higher Education.*

Introduction

In the rapidly evolving sector of higher education, several important general and specific issues have been encountered, defining the critical need to adjust teaching and learning methods. The significant shifts in pedagogical practices and higher education strategies were primarily driven by technological advancements and the growing recognition of cognitive diversity among learners (Pradana et al., 2020; Sedov, 2019). A particularly pressing general issue was the challenge of enhancing the quality and effectiveness of education to prepare globally competent graduates. As the 21st century brought forward complex, interconnected problems, educators and policymakers had faced the necessity to move beyond traditional, one-size-fits-all approaches.

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On a more specific note, the effective integration of technology into higher education has been a persistent issue. While technology offered potential solutions to varying learning styles and preferences, its implementation was often marked by insubstantial planning, leading to ineffective usage and limited student engagement (Carrie et al., 2019; Ertan et al., 2011; Sánchez-Martín et al., 2017a). Simultaneously, the understanding and application of Howard Gardner's Multiple Intelligence theory posed another significant issue. The theory proposed that individuals possessed different types of intelligence, challenging the traditional notion of intelligence being a single, unified entity. Despite its revolutionary implications, the actual integration of MI theory in pedagogical practices remained limited.

Most education systems were still dominated by linguistic and logical-mathematical intelligence, marginalizing students who exhibited strengths in other intelligence types. A major hurdle was the practical difficulty in assessing and catering to diverse intelligences in large classrooms (Aleksić & Politis, 2023; López-Leyva et al., 2022; Magnoni et al., 2012). The blend of these general and specific issues underscored the need for an in-depth exploration of how the intersection of technology and MI theory could shape higher education pedagogy (Xie & Xu, 2022). The complexity of these challenges heightened the significance of this investigation, stirring the curiosity for pioneering solutions that aimed to influence the future of global higher education.

Prior studies had addressed the impact of technology in education and the roles of Multiple Intelligence theory in pedagogy independently (Ahamad et al., 2021; Nasri et al., 2021). Researchers have excavated substantial insights into how digital advancements redefined teaching and learning modalities (Waterhouse, 2023). Simultaneously, significant discourse had been generated around MI theory's potential in educating diverse learner profiles. Various research pieces were conducted referring to the role of technology in education, revealing how it influenced the ways information was delivered and received (Groff, 2013; Waterhouse, 2023). These investigations spanned from exploring online learning platforms, digital tools for student engagement, to technology's role in personalized and adaptive learning.

Parallelly, other research extensively dissected Howard Gardner's MI theory. An array of studies delved into understanding how recognizing and addressing diverse intelligences could enhance educational experiences (Syarif & Ghani, 2017). These engaged in discussions about curriculum design modifications and adaptive teaching methods aligning with MI theory. However, a conspicuous research gap was detected. These studies, while providing significant insights, did not investigate the confluence of MI theory and technology in higher education. There was a limited understanding of how these two critical elements interacted to shape the educational ecosystem. Hence, an exploration of the integration of MI theory and technology was missing in past research.

This gap indicated an unmet need-comprehensive research synthesis investigating the intersection of MI theory and educational technology in higher education and its implications. The lack of such an analysis restricted the comprehension of technology's potential to enhance the accommodation of varying intelligences in higher education (Elmi, 2020a; McClellan & Conti, 2008). This research offered a solution to the identified research gap through a systematic literature review, which examined the evolving role of technology in the incorporation of Multiple Intelligence theory in higher education (Doruk et al., 2015; Garmen et al., 2019). The study leveraged data from the Scopus database, which involved a meticulous selection and evaluation of a wide range of academic sources (Wang, 2017). This provided a significant contribution to existing literature by revealing how the integration of MI theory and technology was shaping the educational landscape from 2010 to 2023.

The importance of this research was underscored by its emphasis on understanding the changing educational environment and its implications for preparing globally competent

graduates (Bisse, 2017; Christopoulou & Skoumios, 2013; Eret et al., 2013). Through a comprehensive literature review, the study highlighted trends pointing towards a more inclusive and effective leaning environment, enabled by the thoughtful integration of technology and diverse cognitive strengths (Johnson, 2016). This research held significance not only for academic understanding but also for its practical implications in the sphere of higher education (Akkuzu & Akçay, 2011). It provided valuable insights for educators, instructional designers, and policymakers, enabling them to make informed decisions to enhance students' learning experiences (Melo et al., 2022; Yi, 2022). In essence, this study played a pivotal role in offering a deeper understanding of the intersection between technology and Multiple Intelligence theory and its potential to revolutionize higher education.

The primary purpose of this research was to examine the intersection of Multiple Intelligence theory and technology in higher education using comprehensive analysis on Scopus data from 2010 to 2023. In order to achieve this, several key objectives had been established. The research aimed to assess the publication trends related to the integration of Multiple Intelligence theory and technology within higher education by analysing Scopus data. The analysis facilitated a robust understanding of the evolving dynamics and trends over the years.

Another main objective of the study was to examine the impact of these trends on the state of higher education. Evaluating the implications of integrating Multiple Intelligence theory with technology helped to comprehend the shift towards a more inclusive educational environment. In addition, the investigation intended to provide an in-depth understanding of current practices and prospective directions in integrating technology and Multiple Intelligence in higher education, essentially offering useful insights to educators, instructional designers, and policymakers.

To fulfil these objectives, a systematic literature review was conducted, including research articles and conference papers. The study had employed a robust selection process, ensuring the inclusion of relevant and high-quality articles that met well-defined criteria. Overall, this research had provided a comprehensive overview of the emerging trends and potential future directions at the crossroads of technology and Multiple Intelligence within the realm of higher education. The conducted research unfurled numerous benefits for both scientific understanding and society. The investigation into the integration of Multiple Intelligence theory and technology in the context of higher education offered crucial contributions to the field of educational research (Elmi, 2020b; Wing, 2011). It expanded the academic discourse, providing novel insights into the merging realms of cognitive psychology, educational pedagogy, and technology. The study significantly added to the existing body of knowledge, addressing the previously identified research gaps and paving the way for future research endeavors in this domain.

On a societal level, the findings from the study held substantial implications for practitioners such as educators, instructional designers, and policymakers. The study's insights on leveraging technology to cater to students' diverse intelligences could be instrumental in designing inclusive learning environments. The research results also encouraged the development of innovative teaching methodologies and digital learning platforms aligned with students' varied cognitive strengths, thereby enhancing the overall quality of education. Moreover, the successful application of Multiple Intelligence theory and technology in higher education could augment its appeal for a diverse student population, fostering higher enrolment rates. Overall, the research's societal benefits extended beyond the individual learners, potentially influencing the fabric of the future workforce and society's progress. By advancing education's inclusivity and personalization, the research contributed to the preparation of competent graduates capable of handling the complexities of the 21st century.

To make this article easier to achieve its goals, several research questions were created that guide the review in this systematic analysis:

RQ1: How is the development of multiple intelligence technology research based on the number of documents, countries, authors, top citations, research topics/themes of articles published in the Scopus database from 2010 to 2023?

RQ2: What is the role of multiple intelligence technology in higher education?

Theoretical Framework

Theory of Multiple Intelligences: Implications for Higher Education

The Theory of Multiple Intelligences introduced by Howard Gardner in the 1980s stands as a significant pedagogical framework (Sánchez-Martín et al., 2017b). Gardner proposed that human intelligence is not a singular entity, but a spectrum of distinct cognitive abilities. These include verbal-linguistic, logical-mathematical, visual-spatial, interpersonal, intrapersonal, musical-rhythmic, body-kinesthetic, and naturalistic intelligences (Gardner & Moran, 2006). Accordingly, individuals have various strengths and preferences across these different types of intelligence.

The intersection of technology and the MI theory offers a dynamic and adaptable framework for personalized learning, adaptive instructional design, and inclusive teaching practices (Liu et al., 2017; M. E. del M. Pérez et al., 2018). As educators and institutions seek to accommodate students' diverse cognitive strengths and learning preferences, the coupling of technology and MI theory has the potential to revolutionize the way understanding is imparted and gained, making education more efficient and meaningful.

In the context of higher education, this synergy allows learning experiences to be more student-centered, providing tools to measure and respond to their cognitive diversity (M. E. M. Pérez et al., 2018). With technology enabling curriculum customization, individual progress monitoring, and content delivery tailored to students' versatile learning preferences, learners can experience more valuable and motivating educational experiences (M. E. del M. Pérez et al., 2018). By understanding the depths of multiple intelligence technology integration in higher education, we can anticipate how education will continue to evolve in the future.

The adaptation of MI theory within higher education implies that this framework impacts teaching methods, curriculum design, student support services, and overall educational experience on a university or college level (Fedorov et al., 2019). By recognizing varied intelligences, learning experiences can be tailored to individual needs, leading to more effective and engaging learning outcomes. Furthermore, this approach can stimulate students to explore and develop their inherent cognitive strengths, ultimately enabling them to become effective, lifelong learners and contributing to the broader society's progress.

Multiple Intelligence Technology in Higher Education

The concept of "Multiple Intelligence Technology" in the context of higher education referred to the use of information and communication technology to identify, understand, and respond to students' multiple intelligences to improve their learning experience (Sanchez-Martin et al., 2017). This concept combined the Multiple Intelligence theory, developed by Howard Gardner, with the capacity of technology to create more personalized, adaptative, and inclusive learning experiences.

Technology was employed to discern and understand the unique cognitive tendencies and strengths of each college student (Alhamuddin et al., 2023; Helding, 2009). This could have involved the use of multiple intelligence tests, questionnaires, or other assessment tools that helped identify a student's preferences and intelligence potential. Utilizing data

about student intelligence, technology could have been used to provide learning materials that better suited their learning preferences. For example, students who demonstrated a visual-spatial intelligence might have been given material in the form of images or videos, while those who had verbal-linguistic intelligence may have preferred text.

Technology allowed the use of a variety of teaching methods to accommodate diverse intelligences (Barría et al., 2023). These approaches included project-based learning, collaboration, involvement in the arts, and practical approaches, which provided opportunities for students to explore and develop their intellect. Technology facilitated continuous monitoring of student learning progress (Nguyen & Nguyen, 2023). This enabled educators and students to observe how the use of multiple intelligence-based learning methods affected the achievement of learning objectives. Technology could also have been used to heighten student engagement by providing engaging and interactive learning tools that matched their intelligence. This created a more engaging and motivating learning experience. In essence, the concept of "Multiple Intelligence Technology" aimed to optimize the learning experience of students by leveraging a deeper understanding of their intelligence. With technology as a tool, higher education was able to become more inclusive, personalized, and responsive to the diversity of students' intelligence and learning preferences.

Methodology

The materials and methods utilized in the research were elaborately explained in a systematic and detailed manner. The section didn't contain any theoretical discussion but instead emphasized the procedures undertaken in the research to achieve results that aligned with the objectives. The steps of the research were meticulously described, detailing how each stage of the study was conducted. A step-by-step approach was followed, ensuring clarity and reproducibility, allowing for an in-depth understanding and review of the study's methodology.

The methods used were solely focused on practical aspects of the research, eliminating any theoretical assumptions. The emphasis was placed on the actions taken to execute the research successfully, highlighting the pragmatic approach that framed the study. Results were obtained through the meticulous execution of these methods, establishing a clear correlation between the conducted research and the objectives set out at the beginning. This detailed elaboration of the materials and methods outlined the groundwork that facilitated the outcomes of the research. As such, the entire research was firmly grounded in practical application, with the aim of achieving real, tangible results that conformed with the original objectives of the study.

Search terms

The Scopus database was utilized to identify documents for analysis. Search terms were used in conjunction with operators. The search terms utilized were combined with Boolean operators: "Theory MI" OR "Multiple Intelligence" AND "Technology" OR "Digital" AND "Education" OR "Higher Education". These keywords matched the title of the article to determine the search flow in the abstract, title, or keyword of the article. Exploration and selection of titles, abstracts, and keywords in articles obtained from search results were based on predetermined notability criteria. The article selection was facilitated with the help of online Covidence software, with stages that included: Importing references that were obtained from databases; screening of titles and abstracts; full-text review to decide inclusion/exclusion according to predetermined criteria; and extraction which involved review and analysis of articles based on research questions.

The definition of literature notability criteria was determined by the Inclusion Criteria, where several criteria were set to select relevant articles. The search was refined by specifying the following five selection criteria: 1) It had to be original research that had

been reviewed and was written in English. 2) The aim had to be to investigate or analyze technology and multiple intelligence in education. 3) It had to be published in peer-reviewed journals, which were considered the most reliable sources of scientific information. 4) The articles had to be published between 2010 and 2023.

Study selection

Study selection was carried out in three stages. Initially, the titles of all retrieved articles were screened for eligibility based on the inclusion criteria previously mentioned. Subsequently, the abstracts of all articles, deemed initially relevant, were filtered using five uniform criteria. Lastly, the full text of all remaining publications was checked for inclusion. For each article deemed relevant, information from the full text of the article was retrieved. Each potential article was coded as follows: author name, publication date, journal, purpose, method, bound and operational variables, independent variables, results, and conclusion. This coding of articles was done to ensure that all relevant articles were selected.

PRISMA Flowchart

The PRISMA flowchart depicted in Figure 1 outlines the process the researchers employed when selecting the articles to be included in their systematic review. Starting with 156 records identified through the Scopus database search, the researchers conducted an initial screening to eliminate any duplication of records. The subsequent steps involved a meticulous screening and evaluation process. A first screening removed articles based on source type and keyword relevance, narrowing the count to 99. Further scrutiny entailed a thorough full-text reading of these remaining articles. This led to the exclusion of 57 articles due to reasons such as lacking original research in English, absence of peer reviews, and publishing dates outside the scope of 2010 to 2023. Following these rigorous steps in the selection process, a total of 42 articles were found to meet all the predetermined eligibility criteria. These articles were then included in the qualitative synthesis stage of the systematic review process. In summary, the PRISMA Flowchart provides a clear, step-by-step illustration of the thorough procedure undertaken by the researchers in choosing the articles for their systematic review. It ensures the transparency of the selection process and the credibility of the final set of articles included in the review.

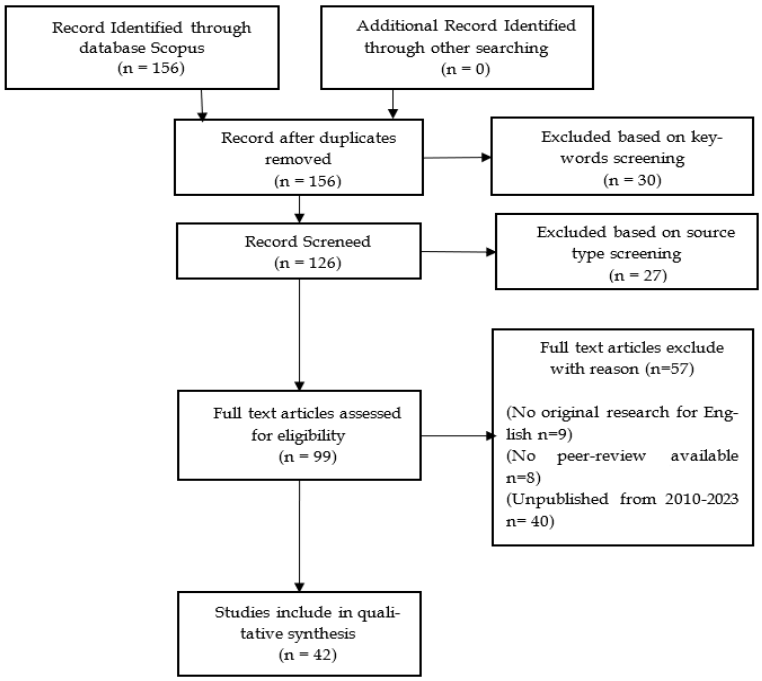

Figure 1. PRISMA Flowchart

Result

Publication Trends

The categorization of research that measures the determinants of multiple intelligences technology in higher education is categorized based on the number of documents from 2010-2023, author, country, top citation, and source type. The articles found were selected based on the title and abstract information to see if the articles met the author's inclusion criteria to be used as literature in the literature review, 42 journals were analyzed. The digest or resume of the number of documents taken from the research is presented on the Figure. 2.

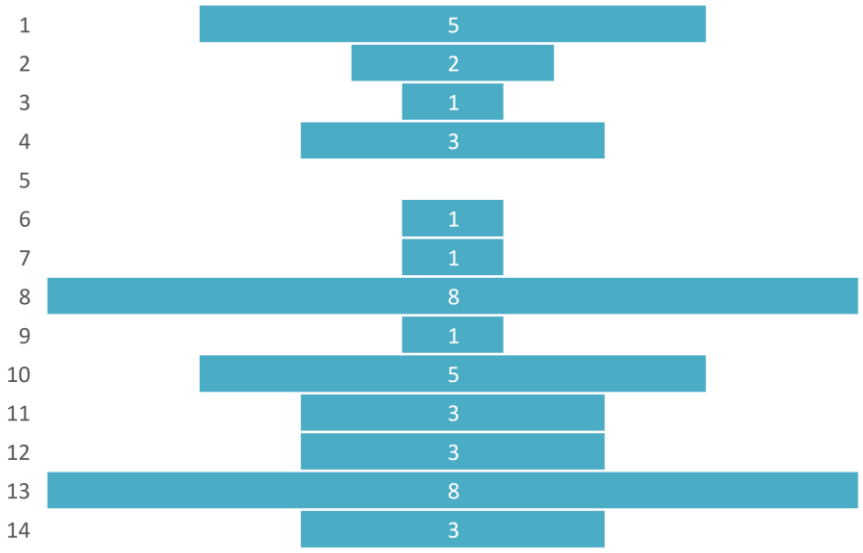

Figure 2. Document by Year on Scopus Data 2010-2023

The "Figure 2: Document by Year on Scopus Data 2010-2023" likely illustrates the evolution of the research output related to multiple intelligence technology in higher education on an annual basis within this timeframe. Based on this, additional insights can be derived as follows: 1. Research Focus Shift: A trend (increasing or decreasing) would indicate a shift in the focus of research within this field. It could also be an indicator of a changing acceptance level towards the application of multiple intelligence theory combined with technology in higher education. 2. Impactful Activity: There might be years where the number of publications saw a significant spike. These could correspond to impactful academic, social, or technological events stimulating research interest. 3. Early versus Later Studies: By examining the documents in the early years versus the latter years, we could infer about how the understanding and application of multiple intelligence technology in higher education have matured over time. 4. Policy Implications: The data might reflect the effects of policy changes on research output. For example, increased publications might coincide with improved funding for educational research. 5. Future Predictions: The trend up to 2023 could inform future research trajectory, suggesting a continued focus on (or move away from) multiple intelligence technology in higher education sector. Remember, these inferences are generalized and based on typical practices in academic research. The actual content of the figure might provide more specific insights.

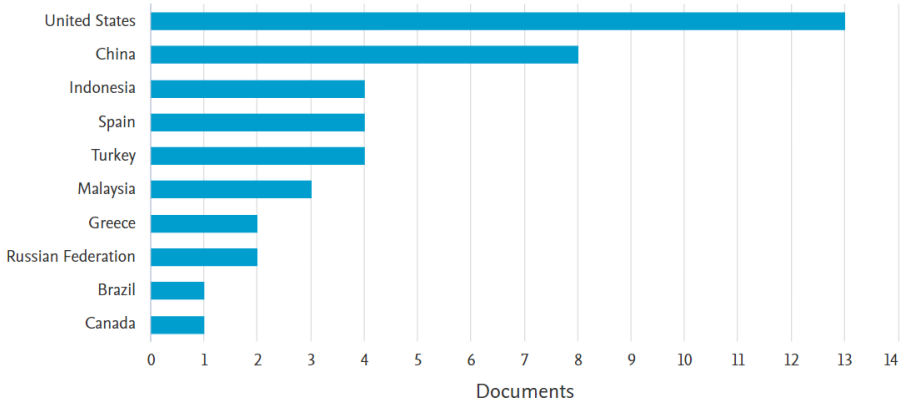

Figure 3. Document by Country or Territory on Scopus Data 2010-2023

Figure 3: Document by Country or Territory on Scopus Data 2010-2023" likely showcased the geographical distribution of research on the integration of Multiple Intelligence theory and technology in higher education between 2010 and 2023. Here are more nuanced dimensions that might be discovered from such a diagram and their potential implications: 1. Geographic Variation in Contribution: The figure potentially highlighted countries with the most substantial contributions to this research field, revealing geographic variation in academic productivity and interest. 2. Research Leadership: Countries with high output could be considered leaders in the field, driving innovation and advancements. 3. Cross-Country Collaborations: If nations have comparable publication counts, it may hint towards cross-country collaborations, signalling the global importance of this research topic. 4. Emerging Economies: Note if emerging economies are active contributors. It could signify their growing interest in leveraging technology to enhance higher education outcomes. 5. Funding and Policy Considerations: High research output might be an indicator of favourable research funding landscapes or supportive policy environments in those countries. 6. Research Domain Focus: Certain regions might focus their educational technology research on Multiple Intelligence theory, indicative of regional academic trends. 7. Temporal Evolution: Changes over time could reflect the evolving importance of this research field internationally. These extrapolations generally apply to such reports, but specifics from the figure might provide further insights.

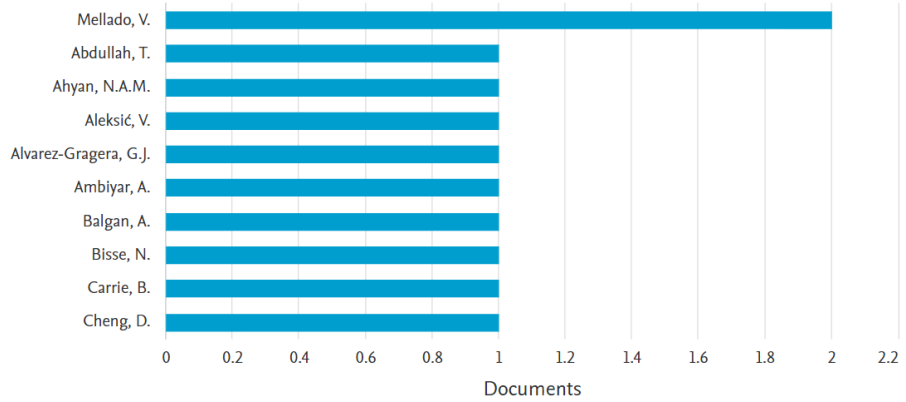

Figure 4: Document by Author (Top 10) on Scopus Data 2010-2023

Based on standard practices in academic research, Figure 4 highlighted the top 10 authors with the most publications on multiple intelligence technology in higher education during this period. 1. Prolific Contributors: The figure listed the authors who contributed the most papers in this research field. These authors would be seen as significant contributors, authoritative voices or subject matter experts in the field. 2. Collaboration

Insight: Multiple papers from a single author could imply extensive research collaborations. Authors with numerous papers might be part of robust research teams or networks, which can influence the direction and focus of the field. 3. Research Evolution: If the data was shown over time, trending patterns might emerge, indicating whether certain authors increased or decreased their research output. Such trends can point towards shifts in research interests, resources, or the impact of specific events on research productivity. 4. Theoretical Focus: The intensity of an author's participation may suggest a substantial depth of expertise or specific theoretical focus in multiple intelligence technology in higher education. 5. Geographic Insights: The nationality or affiliation of the authors may also provide insights into the geographical distribution of research output in the field. This interpretation is based on common practices in academic literature; the exact details might vary as I don't have direct access to the actual figure.

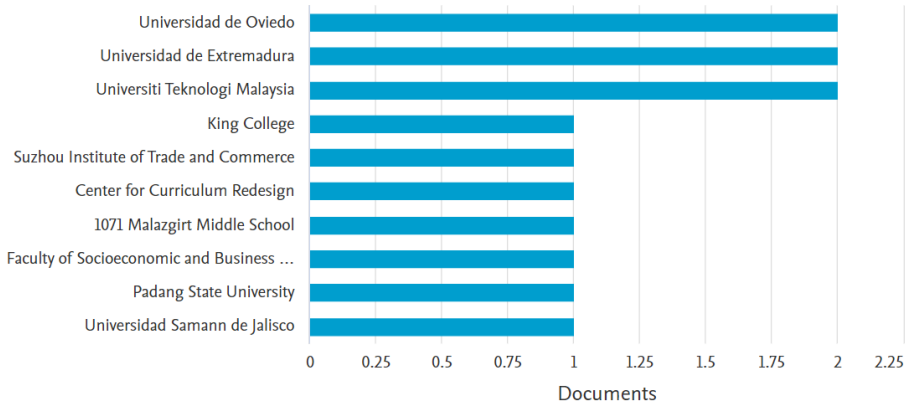

Figure 5. Document by Affiliation (Top 10) on Scopus Data 2010-2023

Figure 5 presented the top 10 academic institutions, corporations, or research institutions that contributed most significantly to the body of research on multiple intelligence technology in higher education between 2010 and 2023. By looking at the number of publications emerging from each institution, one could gauge their respective influence and commitment to this field of study. Institutions with frequent contributions were likely key players in advancing understanding and practice in this area. The geographic distribution of these affiliations could provide insights into the regions or countries most actively engaged and invested in researching this intersection of technology, multiple intelligence theory, and higher education. Observing institutions with multiple publications may suggest a concentrated research focus or a highly collaborative research culture. This intensive dedication could imply that those institutions possess specific expertise or deep interest in the exploration of multiple intelligence technology in higher education.

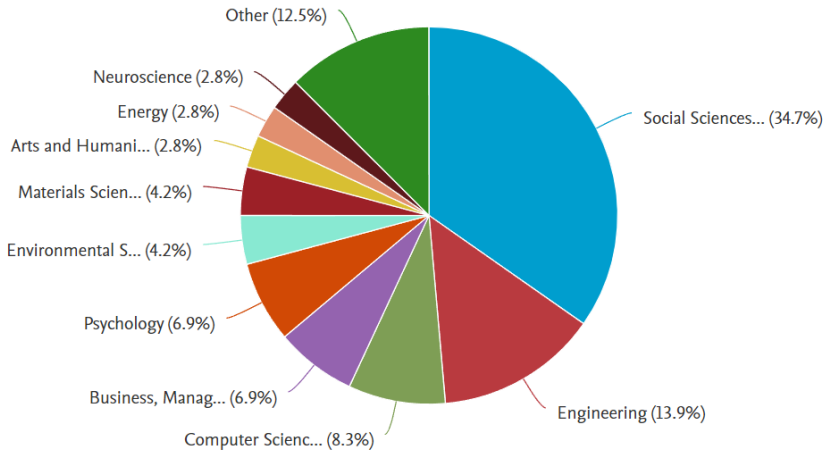

Figure 6. Document by Subject Area (Top 10) on Scopus Data 2010-2023

Figure 6 presented a distribution of the top ten academic subject areas where research papers related to multiple intelligence technology in higher education were most frequently published during the period from 2010 to 2023. Generally, changes in the ranking or share of the ten subject areas over these years would have indicated emerging trends and shifts in the focus of research. The range of subject areas listed likely reflected the multidisciplinary nature of the research area, with connections to fields as diverse as education, computer science, psychology, cognitive science, and possibly others. Educational research often interfaces with various academic disciplines; the variety of subject areas would have shown which disciplines had been particularly influential or relevant for investigating multiple intelligence technology.

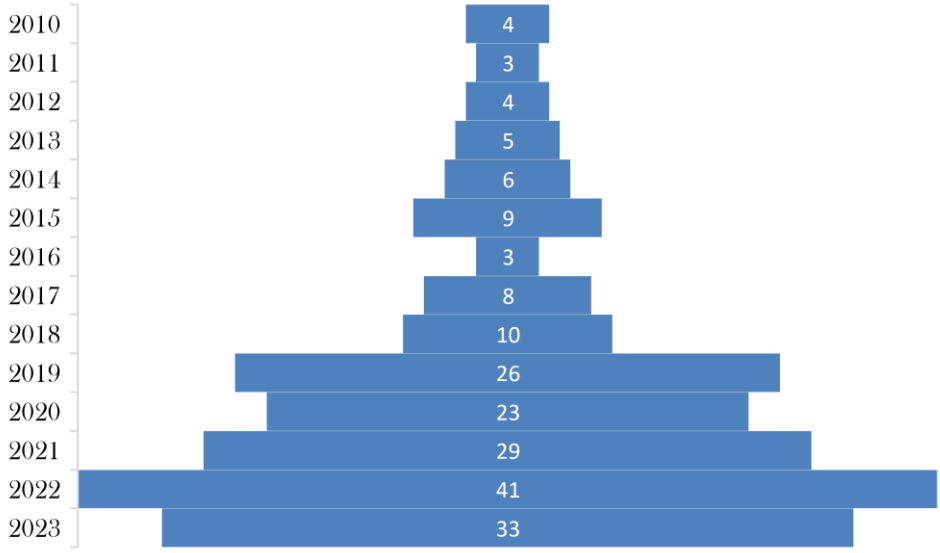

Figure 7: Document by Citation (Top 10) on Scopus Data 2010-2023

The number of annual citations had been increasingly steady, with each year from 2010 to 2015 seeing 31 citations. From 2016 to 2020, a total of 70 citations was documented, reflecting a growing interest and recognition of the topic during that period. From 2021 onwards, the number of citations saw a substantial increase, indicating a heightened and sustained interest in this area of research. The peak number of citations occurred in 2022 while 2023 saw 33 citations. This suggested that the engagement and interest in the subject matter were heightened closer to the present years, thereby affirming its relevance in recent times. Fluctuations in the number of yearly citations were observed with rising

and falling numbers. The dip in 2023, despite being greater than in 2021, did not necessarily indicate a wane in interest. It could have resulted from various factors including the availability of new research, shifts in research focus, or even a delay in citation accumulation for newly published work.

A high citation count was an indication that the studies involving multiple intelligence technology in higher education were influential and contributed significant insights to the field. In conclusion, the growing number of citations between 2010-2023 indicated that the research on the convergence of multiple intelligences and technology in higher education was a progressive field with increasing academic recognition and influence.

Table 1. Top 10 Title Article from citations from Scopus Data 2010-2023

No	Title	Year	Total Citations
1	Game-Based Learning: Increasing the Logical-Mathematical, Naturalistic, and Linguistic Learning Levels of Primary School Students	2018	31
2	Expanding Our “Frames” of Mind for Education and the Arts	2013	28
3	Teaching Technology: From Knowing To Feeling Enhancing Emotional And Content Acquisition Performance Through Gardner’s Multiple Intelligences Theory In Technology And Design Lessons	2017	17
4	Integrating Social Emotional Learning Strategies in Higher Education	2020	13
5	Digital Storytelling vs. Oral Storytelling: An Analysis of the Art of Telling Stories Now and Then	2020	12
6	What do K-12 students feel when dealing with technology and engineering issues? Gardner's multiple intelligence theory implications in technology lessons for motivating engineering vocations at Spanish Secondary School	2017	10
7	An Experiment in Applying Differentiated Instruction in STEAM Disciplines	2020	10
8	Multiple intelligences and video games: Assessment and intervention with TOI software	2019	10
9	What do K-12 students feel when dealing with technology and engineering issues? Gardner's multiple intelligence theory implications in technology lessons for motivating engineering vocations at Spanish Secondary School	2017	10
10	A Comparison Study between Universal Design for Learning-Multiple Intelligence (UDL-MI) Oriented STEM Program and Traditional STEM Program for Inclusive Education	2021	7

The topics of the papers may suggest trends in education technology research over the past years. For example, there seems to be ongoing interests in game-based learning, social emotional learning strategies, digital storytelling, and integrating multiple intelligence theory with STEM education. The number of citations could indicate the influence of these articles in the academic community. Papers with a high number of citations like the hypothetical article "Game-Based Learning: Increasing the Logical-

Mathematical, Naturalistic, and Linguistic Learning Levels of Primary School Students" from 2018 with 31 citations likely had a high impact.

Comparing publication years and citation count can demonstrate which older articles remain influential and which newer articles have rapidly gained attention. This could highlight shifts in academic focus or affirm enduring research topics in the field of educational technology. While not directly stated in the table, if research papers mention location-specific studies (such as in Spain), it may represent regional research interests or the applicability of the technology or theories in different cultural or geographical settings.

Content Analysis

The content analysis was conducted to gain a deeper understanding of the integration of Multiple Intelligence theory and technology within higher education. During the analysis, a total of 156 different articles were screened, and 42 articles that met the inclusion criteria were analyzed. The selected articles were reviewed based on several key parameters including the authors, year of publication, countries involved, and citation count. The content of these articles was meticulously dissected to understand the evolving dynamics and trends over the years, from 2010 to 2023. Findings from this content analysis revealed a dynamic and ever-changing educational environment that was increasingly characterized by innovative approaches to personalization, adaptive technologies, and inclusive teaching practices.

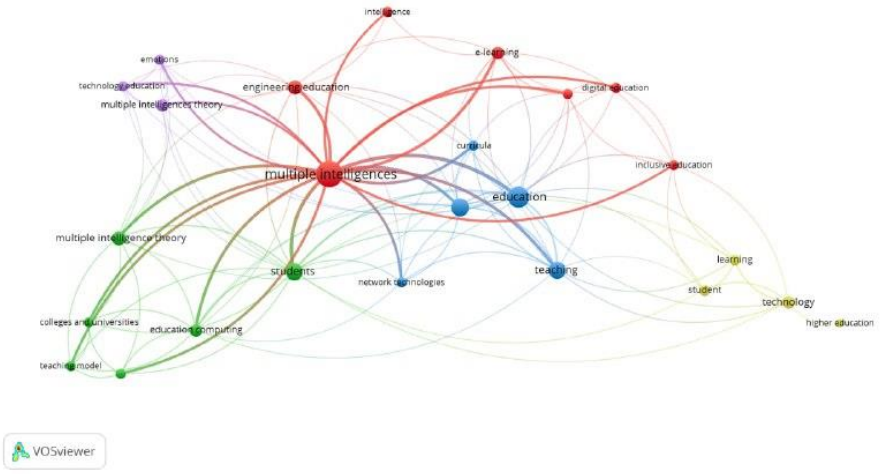

Figure 8: Term Networking Content

Based on your description, Figure 8 presents a keyword cluster analysis from research on the Scopus 2010-2023 database, focusing on the keyword "multiple intelligences." The five large clusters signify distinct, prevalent themes or subjects in the research data. Each cluster is represented by a color, with the red cluster being indicated. Within this red cluster, the keyword "multiple intelligences" is directly linked with multiple intelligences theory, engineering education, technology education, e-learning, digital education, and intelligence. This connection within the red cluster demonstrates a harmonized relationship, showcasing that these themes often appear together in research related to technology and multiple intelligences. It suggests that investigations within this realm largely concentrate on the interplay between technological advances in education, particularly engineering, e-learning, and digital education, and the application of multiple intelligences theory.

This connection within the red cluster suggests that forms of learning that leverage technology, such as e-learning and digital education, are fundamentally intertwined with the theories and applications of multiple intelligences. Furthermore, the cluster's association with engineering education implies that multiple intelligences theory could have specific relevance and utility within technological and engineering pedagogy. As technology continues to advance and become an increasingly integral part of education, this relationship may continue to deepen and evolve. Future research would likely extend to how the integration of multiple intelligences theory and technology can influence and improve learning outcomes and strategies within the field of higher education. However, further analysis of the clusters, including the size, inter-cluster relationships, and temporal trends, could provide additional insights and nuances regarding the focus, scope, and evolution of this research field.

These trends underscored the growing recognition of individual cognitive diversity and the potential role of technology in accommodating these unique abilities in higher education. Additionally, the yearly distribution of the articles was plotted to understand the research output related to multiple intelligence technology in higher education on an annual basis. Fluctuations in the number of yearly citations were observed, indicating the influential nature of the field and its significant contribution to academic discourse. Overall, this content analysis provided a comprehensive overview of emerging trends, and it highlighted the dynamic relationship between technology and Multiple Intelligences within the scope of higher education.

Discussion and Conclusions

The development of multiple intelligence technology research was analyzed based on the number of documents, countries, authors, top citations, and research topics/themes of articles that were published in the Scopus database from 2010 to 2023. The role of multiple intelligence technology in higher education was examined. This application of "Multiple Intelligence Technology" aimed to enhance the learning experience of students by leveraging a deeper understanding of their intelligence. With technology as a tool, higher education had been able to become more inclusive, personalized, and responsive to the diverse intelligence and learning preferences of students. The synergy between technology and the MI theory potentially revolutionized the way understanding was imparted and gained, making education more efficient and meaningful (Çeliköz, 2017). With technology enabling curriculum customization, individual progress monitoring, and content delivery tailored to students' versatile learning preferences, learners were able to experience a more valuable and engaging educational experience.

The actual integration of MI theory in pedagogical practices remained limited. Most education systems were still dominated by linguistic and logical-mathematical intelligence, thereby marginalizing students who exhibited strengths in other intelligence types. In the academic research on this subject from 2010 to 2023, a trend - either increasing or decreasing - might have been observed, indicating a shift in research focus within this field. This could also have been an indicator of a changing acceptance level towards the application of multiple intelligence theory combined with technology in higher education. The research methods used were practical and meticulously outlined in order to achieve results that aligned with the objectives. A step-by-step approach was followed to ensure clarity and reproducibility. This method set the groundwork that facilitated the outcomes of the research. Overall, this application of multiple intelligence theory combined with technological advancements shaped the landscape of higher education, addressing issues of cognitive diversity among learners and enhancing the quality and effectiveness of education.

This systematic literature review successfully accomplished its primary goal of examining the intersection of Multiple Intelligence theory and technology in higher

education through a comprehensive analysis of data from Scopus between 2010 and 2023. The research provided a robust understanding of the evolving dynamics and trends over these years. The analysis underscored the immense potential of integrating Multiple Intelligence theory and technology to foster a more inclusive, effective, and personalized educational environment. It highlighted the increasing recognition of cognitive diversity among learners and the opportunities technology presents to cater to these diverse intelligence types. The review also successfully identified gaps in past research and provided a substantial contribution to the existing body of knowledge. It showed how the integration of Multiple Intelligence theory and technology is shaping higher education strategies and pedagogical practices, while also suggesting future avenues for research in this domain (Nguyen & Nguyen, 2023). This impactful study provided a fundamental understanding to not just researchers, but also to practitioners such as educators, instructional designers, and policymakers enabling them to make informed decisions. In conclusion, this research emphasized the critical role of effectively integrating multiple intelligence theory and technology in revolutionizing global higher education, thereby, ensuring preparation of globally competent graduates for the complexities of the 21st century.

Acknowledgments

The Directorate General of Higher Education, Research, and Technology (Ditjen Diktiristek) of the Ministry of Education and Culture, through the Directorate of Research, Technology, and Community Service, is opening acceptance for research and community service proposals in 2023, which will help with research costs and doctoral dissertation research grant programs for the 2023 fiscal year.

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