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Research trends about Visual Basic as a programming language in the learning process: a bibliometric analysis

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ABSTRACT

This study employs bibliometric analysis to systematically explore the Visual Basic (VB) education research landscape, identifying significant trends, influential authors, and future research directions. Utilizing data from Scopus-indexed journals, we examined 529 papers published between 1994 and October 2023, identified through the keywords "visual basic," "visualbasic," "teaching," and "learning." These papers were analyzed using Biblioshiny to generate a bibliometric map, following four steps: data harvesting, data screening, data visualization, and data analysis. Our research reveals critical VB programming trends from 1994 to 2023, with academic output peaking in 2010 and declining since 2007. Ongoing interest is noted due to legacy system applications. Global publication reach facilitates cross-border information exchange, and top affiliations and authors underscore extensive and influential participation in this field. The research emphasizes incorporating fundamental and advanced themes in educational curricula. It suggests future research focusing on new programming paradigms, longitudinal studies, and VB relevance to technological advancements and industrial needs. Enhanced collaboration, interdisciplinary research, and attention to global trends are essential for maintaining the relevance of VB programming education, optimizing legacy systems, improving educational practices, and preparing students for modern programming environments.

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1. INTRODUCTION

Visual Basic (VB) has a long programming history. Microsoft debuted it in 1991, and its ease of use and graphical development environment made it popular [1]. VB has grown over time, with Visual Basic 6.0 being a milestone for its robustness and simplicity. The drag-and-drop interface in VB made Windows program creation fast. Although Visual Basic.NET replaced it, VB remains relevant in legacy systems and influences new programming languages [2]. Visual Basic's history shows how it has shaped software development and programming. Multiple VB versions have improved its features and capabilities for Windows-based application development. Microsoft launched VB in 1991, and its user-friendly interface and speedy development environment made it popular. Later versions like Visual Basic 6.0 improved its robustness and simplicity, making Windows application development easier [3]. VB remains essential in legacy systems and influences newer programming languages, demonstrating its lasting impact on software development. Visual Basic is accessible to novices and experts due to its user-friendly interface. The

language's simplicity makes learning basic programming principles easier [4]. For constructing expert systems, VB shows its versatility and adaptability in software development [5]. Visual Basic also helps create interactive instructional tools and games, enhancing programming education and engagement [6]. The language's Windows compatibility and speed in programming time make it important in quality control and automation [7], [8]. Visual Basic's influence on programming education, software development, and system automation makes it an important programming language.

Programming languages are essential in learning as they help acquire syntactic, conceptual, and strategic information [9]. It is common for students to begin with block-based languages before moving on to text-based languages. This emphasizes the significance of comprehending how knowledge may be transferred between different programming languages [10]. Acquiring proficiency in a programming language necessitates engaging in practical activities and actively producing code, with a strong emphasis on hands-on experience [11]. Novices can enhance the quality of their software solutions by combining effective software development practices with language acquisition [12]. Typically, the learning process begins with mastery of language aspects and then progresses to developing algorithms for problem-solving [13]. Emotions also substantially impact the results of learning programming languages [4]. Engaging in programming education provides substantial educational benefits as it fosters the development of computational thinking and problem-solving abilities, which are essential for young learners [14]. Given the significance of coding as a vital ability for future generations, including programming education in schools is becoming increasingly crucial [15]. Parental involvement and support play a crucial role in enabling the successful implementation of programming instruction in P-12 schools [16]. Learning programming and coding improves problem-solving skills and helps create strategic knowledge [9]. Incorporating effective software development practices when learning a programming language assists beginners in creating high-quality software solutions [12].

Visual Basic (VB) is taught to improve students' programming skills. Teachers have simplified programming principles using tactile teaching methods and interactive modules [17]. This method follows the trend of using novel tools to teach medical subjects like ultrasound [18]. Additionally, competency-based education and online learning platforms support VB integration into curricula [19], [20]. VB use in education reflects a larger trend toward improving pedagogy and infusing practical skills into varied curricula. Interactive modules and tactile teaching tools improve students' programming skills while using VB in education [21]. Using new techniques like ultrasound in medical education to improve learning outcomes is a trend [18]. VB also enables competency-based education and online platforms, which improves practical skill development [19], [20]. VB helps educators simplify programming ideas, matching with pedagogical changes toward practical skill absorption. VB is used in education because of its simplicity, productivity, and affordability [22]. Teachers can benefit from VB's practical skill development and competency-based teaching [19], [20]. VB is easier to use and port than C# and Java, making it a better language for teaching programming [23].

Based on the findings of previous research, bibliometric analysis stands out as an effective method for comprehending the current trends in research [24]–[31]. A specific gap in the literature relating to Visual Basic in education prompted the performance of a bibliometric analysis to gain insights into the trends and impacts of research in this field. Despite its longstanding presence and continued relevance, Visual Basic education research had not undergone a comprehensive bibliometric analysis. This study seeks to employ bibliometric analysis as a systematic, data-driven approach to understand the landscape of Visual Basic education research, identify significant trends and influential authors, and outline future research directions.

2. METHOD

The research for this study utilized data from papers published in Scopus-indexed journals. By leveraging the Scopus database, we were able to access scholarly articles relevant to our research. Our search strategy involved using the keywords "visual basic" or "visualbasic" and "teaching" or "learning" to identify publications regarding the use of visual basic in educational contexts. These keywords were applied to search article titles, abstracts, and keywords, resulting in a collection of 529 papers that were further analyzed based on specific themes. The study encompassed articles published from 1994 to October 2023, without any temporal constraints. To organize the collected articles, we stored them in the *.ris file format. Additionally, biblioshiny was employed to generate a bibliometric map for visualizing and analyzing research patterns. The research followed four steps: i) data harvesting, ii) data screening, iii) data visualization, and iv) data analysis. Figure 1 illustrates the research stages [32]–[41].

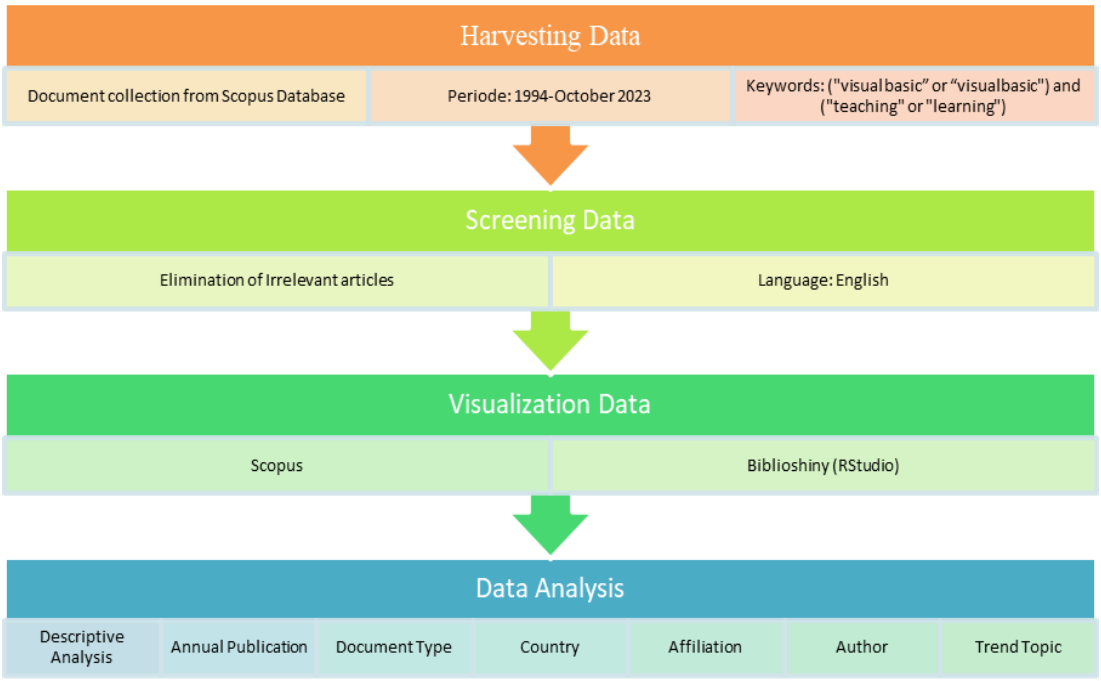

Figure 1. Effects of selecting different switching under dynamic condition

3. RESULTS AND DISCUSSION

3.1. Results

Figure 2 shows the annual VB programming publication output from 1994 to 2023 from Scopus. In recent years, especially 2020–2023, the number of publications has generally stayed between 15 and 21. 2010 was the year with the most publications, followed by 1999 with 4 and 1994 with 5. The number of VB publications has changed, showing different degrees of interest or research. Since 2007, the number of publications has fallen, with a few outliers, presumably due to technology and programming language developments. More research may be able to explain these trends.

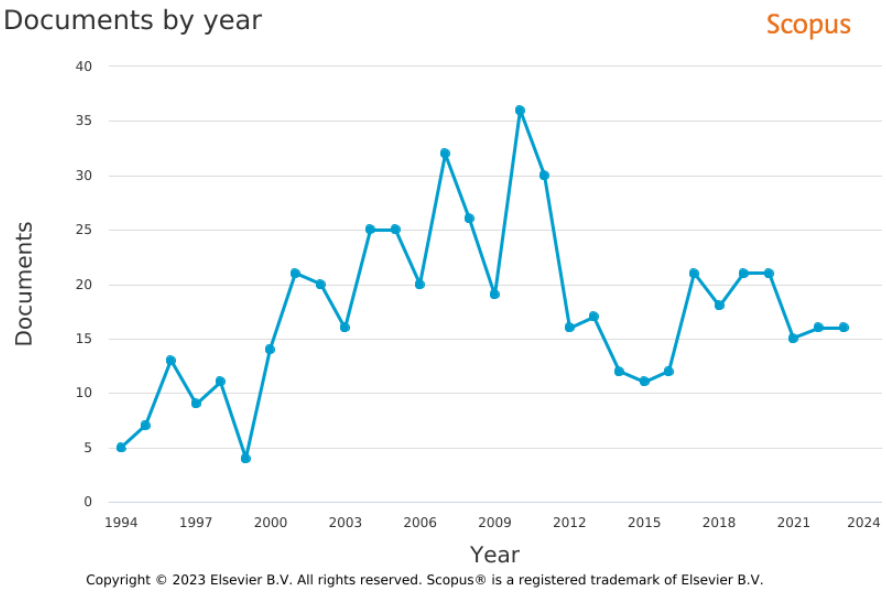

Figure 2. Annual publication of Visual Basic in learning process

Document types in Scopus for VB publications vary. Most entries, 277, are conference papers, indicating that VB is a prominent academic conference topic. There are 227 publications on VB, indicating extensive research. Nine books—possibly textbooks or guides—provide in-depth language material. Five conference reviews provide critical assessments and subject overviews. The minimal number of retracted publications (4) and book chapters (2) shows that VB content is incorporated in larger volumes or compilations, contributing to the diversity of this field's literature in Figure 3.

The Scopus database shows that the top 10 countries with the most VB language programming in learning articles vary in their interest. The United States leads with 168 publications, showing great interest in educational VB programming. With 68 articles, China conducts extensive research. The UK, Taiwan, and Malaysia tie for third with 22 publications apiece, showing similar engagement. Indonesia takes sixth with 19 publications, followed by Japan with 18 publications and India with 15. With thirteen publications each, Canada and Spain tie for eighth. In Figure 4, these nations represent the majority of Scopus' VB programming for learning study.

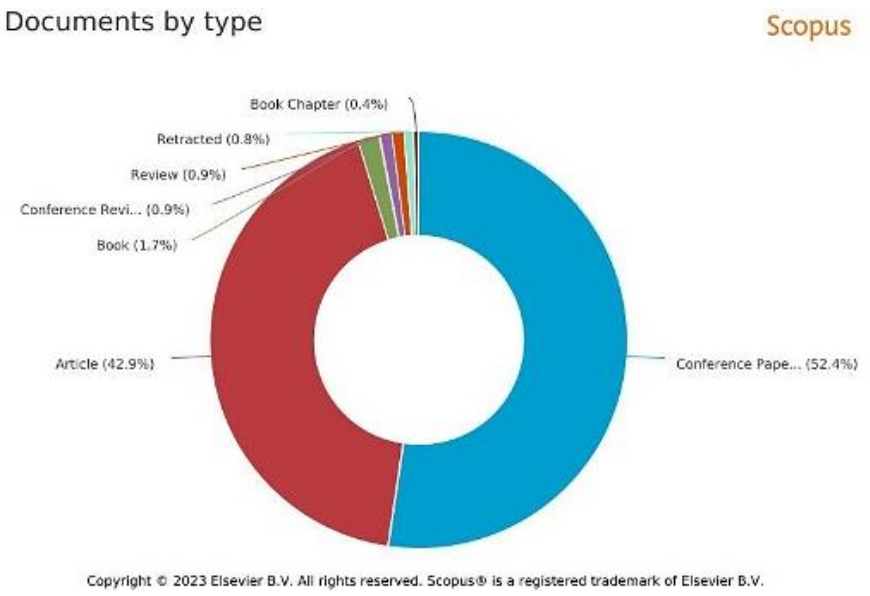

Figure 3. Document type of Visual Basic in learning process

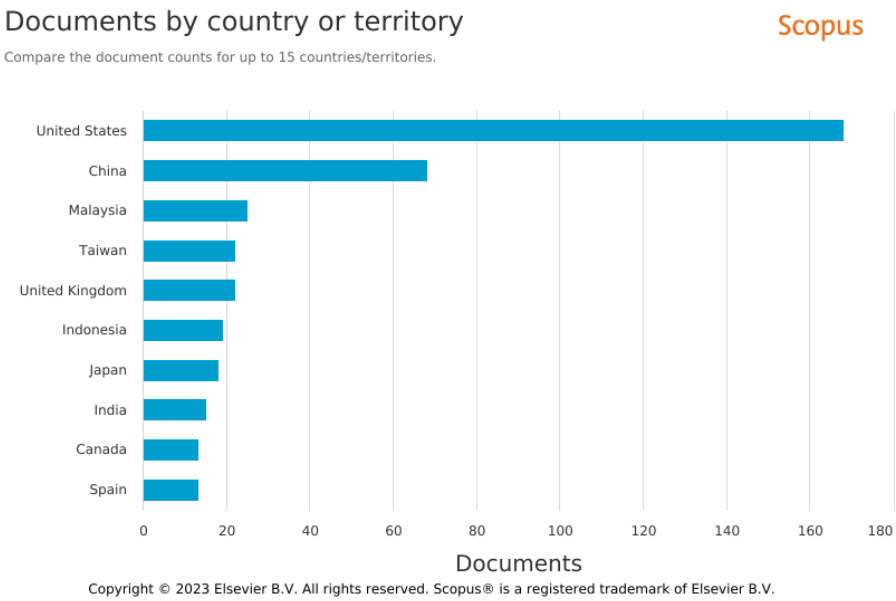

Figure 4. Top 10 countries production of Visual Basic in learning process

The top 10 affiliations with the most VB language programming in learning papers on Scopus cover a wide range of organizations actively contributing to this topic. With eight papers, Universiti Teknologi MARA shows its commitment to educational VB research. Virginia Polytechnic Institute and State University follow with seven publications. The UAE University ranks third with six publications, showing participation. The National Defense Academy of Japan and Christian Brothers University share fourth place with five publications. Figure 5 suggests that Chienkuo Technology University Taiwan, South Carolina State University, Western New England University, Georgia State University, and Drexel University all have four publications, demonstrating their collective contributions to VB programming for learning.

The top 10 Scopus writers of educational documents on VB programming offer a diverse range of experience and insights. Five papers put M. Mimura at the top [42]–[46], proving his significant and influential presence on this subject. By publishing it four times each, M. Bernard, E.E. Rohaeti, and D.C. Yu show their dedication to instructional VB research. J. Aflaki, B. Arifin, S. Demir, S. Dini, K. Eguchi, and A. Gomez-Rivas each had three articles, adding to the depth and breadth of knowledge in Figure 6.

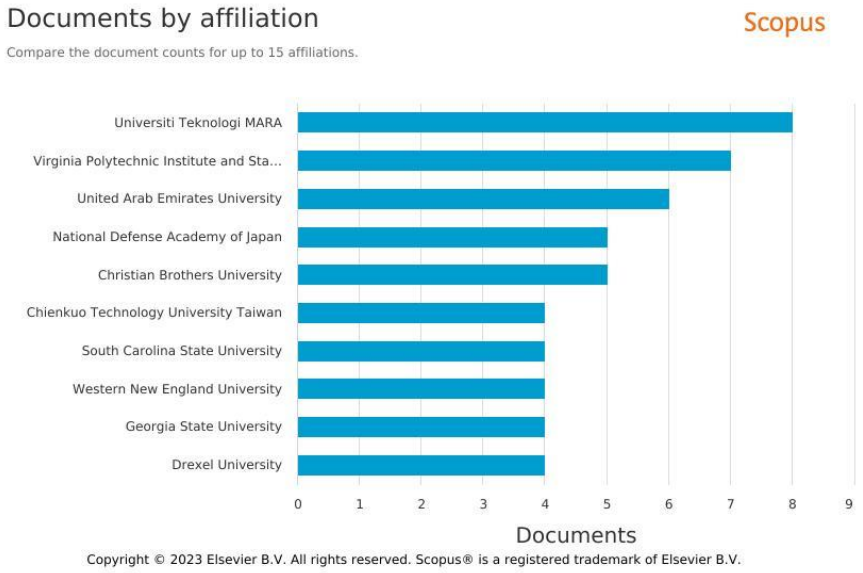

Figure 5. Top 10 affiliations production of Visual Basic in learning process

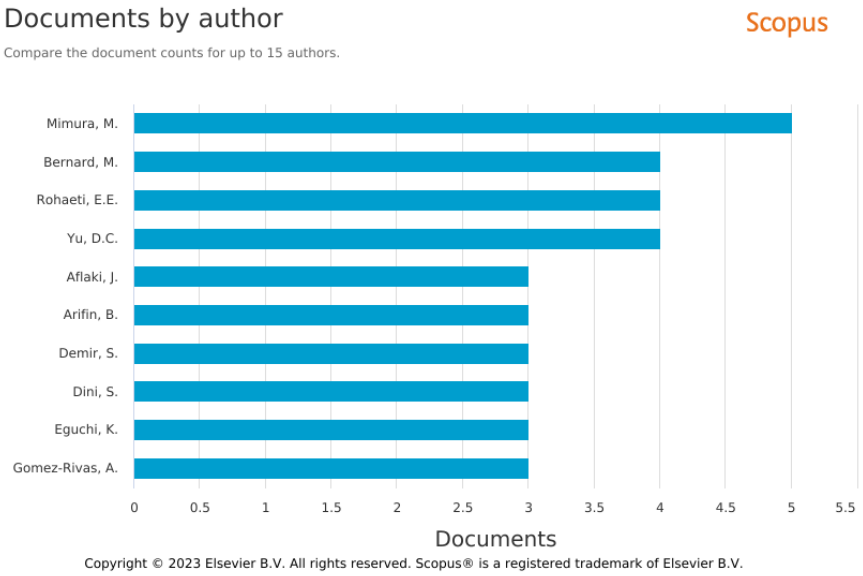

Figure 6. Top 10 authors of Visual Basic in learning process

Scopus data shows the progression of research interests in VB programming language learning. In the early 2010s, "visual basic programming," "basic concepts," and "information management" were studied. In the late 2010s and early 2020s, "machine learning" became popular. "Visual basic" has been the research issue for years, with education, teaching, and curriculum creation remaining significant. In the mid-2010s, "visual basic for applications" and "visual languages" became popular. In Figure 7, "application programming interfaces (API)" have become popular subjects in recent years, demonstrating the changing landscape of VB programming in learning.

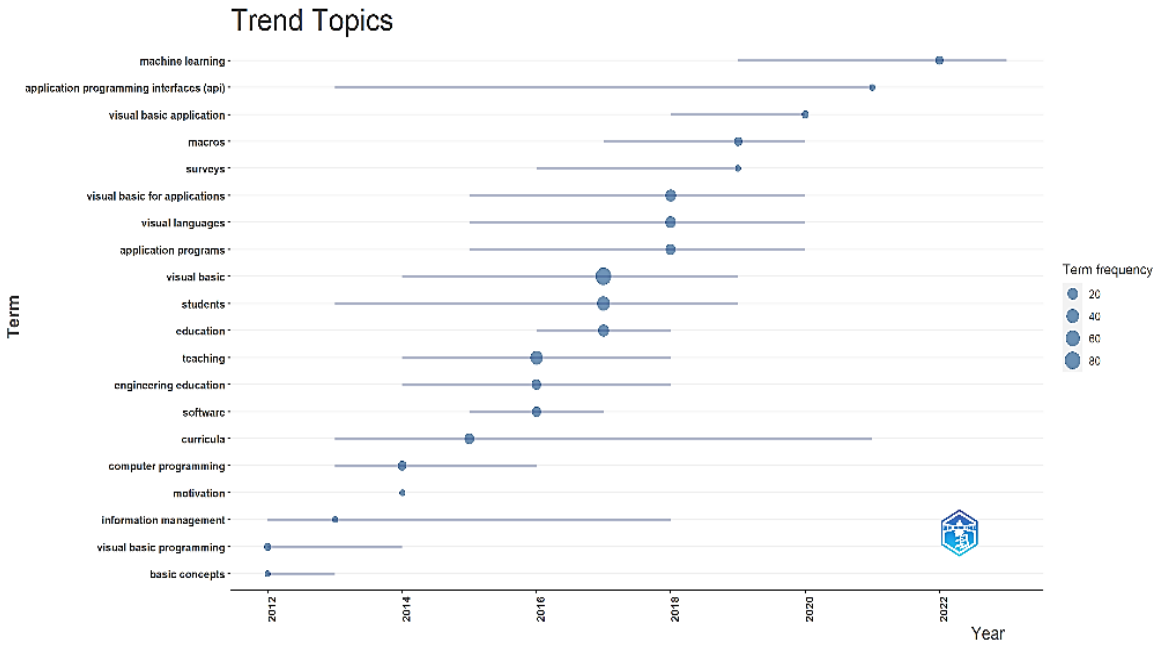

Figure 7. Trend topics of Visual Basic in learning process

3.2. Discussion

Between 1994 and 2023, the publication patterns associated with VB programming exhibit peaks between 2010 and 1999. These peaks indicate that there was either a major increase in academic interest in VB during those years or that significant improvements were made in the language during those years. In contrast, VB has been on the decline since 2007, which coincides with the growth of more recent programming languages, such as Python and C#, which have eclipsed it. Despite this, the number of publications has remained consistent between 15 and 21 over the past few years, indicative of the continued interest in the subject, most likely because of its application in legacy systems. According to these patterns, the influence of technological improvements on academic interest is becoming increasingly apparent. Educational institutions may need to reconsider the emphasis placed on VB in their courses in favor of contemporary languages [23], [47], [48]. This would make it possible for research opportunities to be explored in order to optimize legacy systems.

The several types of documents that may be found in Scopus related to VB publications provide insightful information about the research landscape. Within the realm of academic conferences, the presence of conference papers, which total 277 entries, is indicative of the presence of active discussion and collaboration. The availability of books (9) demonstrates a continued interest in VB, while general publications (227) indicate that education and advanced research are supported. Critical evaluations are provided by conference reviews (5), and the minimum number of articles that were retracted (4) demonstrates a high level of research integrity. The substance of book chapters (2) regarding the language demonstrates the incorporation of VB into broader academic contexts. These findings highlight the multifaceted character of VB research and the significance of academic conferences for information exchange and collaboration. They also highlight the necessity of supporting events of this sort [49], [50].

According to a review of the Scopus database featuring these publications, there is a wide range of interest in VB programming articles across the top 10 nations. The United States of America is in the lead with 168 articles, followed by China with 68 publications, which indicates that China has robust

commitments to VB in educational research. The United Kingdom, Taiwan, and Malaysia each have 22 publications, which reflects the efforts made by the region. Indonesia, Japan, and India are in close pursuit, each with 19 publications, 18 publications, and 15 publications, respectively. Canada and Spain are the last two countries on the list, each having thirteen publications. As a result of these findings, there appears to be a worldwide interest in VB for educational purposes, with the United States and China demonstrating substantial national priorities. Programming abilities should be strengthened, as demonstrated by regional efforts in the United Kingdom, Taiwan, Malaysia, and Indonesia. Opportunities for international collaboration are presented due to the shared interest, highlighting the importance of policymakers adopting effective tactics based on the examples provided [51].

According to the data provided by Scopus, an analysis of the top ten affiliations with the most publications on VB programming in learning indicates a wide variety of companies actively contributing to this topic. First place goes to Universiti Teknologi MARA, which has eight papers, followed by Virginia Polytechnic Institute and State University, which have seven publications overall. After the National Defense Academy of Japan and Christian Brothers University, UAE University comes in third place with six publications. Both of these universities have five publications apiece. The four publications that Chienkuo Technology University Taiwan, South Carolina State University, Western New England University, Georgia State University, and Drexel University have each produced demonstrate their participation in the development of VB programming in the field of education. Institutions from various locations have acknowledged the significance of programming education, reflected in the institutions' diversity. The large outputs of prominent institutions show that giving research in VB programming a higher priority and providing funds for it could increase the visibility and contributions of other universities. The curriculum can foster Significant academic production by including VB programming [52]–[54]. This is because widespread engagement creates chances for collaborative research, the sharing of resources, and the most effective practices.

When educational publications on VB programming are analyzed, the top 10 Scopus writers are revealed to be a broad and influential set of authors. Following M. Bernard, E.E. Rohaeti, and D.C. Yu, who each have four publications, M. Mimura is in the lead with five papers. The scientific landscape is enriched by the contributions of J. Aflaki, B. Arifin, S. Demir, S. Dini, K. Eguchi, and A. Gomez-Rivas, each of whom made three publications. To influence educational practices, offer significant resources for curriculum building, and promote instructional methodologies and educational practices in VB programming, these writers play a crucial role in advancing these areas [55]–[57].

In the past ten years, there has been a shift in the research patterns pertaining to learning the programming language VB. A change to specialized applications such as "visual basic for applications" and "visual languages" occurred in the middle of the 2010s, after studies had concentrated mostly on basic themes in the early 2010s. A discernible shift towards integrating "machine learning" with VB occurred in the latter half of the 2010s and the beginning of the 2020s. This shift was in line with trends in data science and artificial intelligence. More recently, there has been a focus on "application programming interfaces" (APIs) to fulfil the requirements of modern programming responsibilities. This evolution emphasizes incorporating fundamental and advanced subjects into the educational curriculum. Researchers are investigating emerging technologies and transdisciplinary applications to contribute to this ever-changing landscape [58], [59].

In order to ensure the continued relevance and advancement of VB programming education, future research must embrace a comprehensive approach. This includes exploring new programming paradigms, conducting in-depth studies on publication trends, and assessing VB adaptability to technological advancements and industry needs. To propel VB programming education forward and keep pace with the rapidly evolving technology and education landscape, it is imperative to foster collaboration at national and international levels, champion interdisciplinary research efforts, and prioritize global trends and progress.

4. CONCLUSION

Comparing VB programming papers from 1994 to 2023 reveals key trends and insights. Technological advances and new programming languages may have affected academic interest in VB, as publication output peaked in 2010 and has declined since 2007. The steady number of articles in recent years suggests continuing interest, presumably due to legacy system applications. In addition to books and conference reviews, VB research includes conference papers demonstrating academic debate and teamwork. Publications' global reach allows for cross-border collaboration and information exchange, while top affiliations and authors show VB research's extensive and influential participation. This research, from basic ideas to specialized applications and machine learning integrations, emphasizes the need to include basic and sophisticated themes in educational curricula. Future research should investigate new programming

paradigms, longitudinal studies, and VB relevance to technology advances and industrial needs. National and international collaboration, interdisciplinary research, and a focus on global trends are needed to keep VB programming education relevant, optimize legacy systems, improve educational practices, and prepare students for modern programming environments.

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