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The Use of Robomind to Enhance Computational Thinking in Learning Programming: Abiblometric Analysis

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Abstract

The study seeks to comprehensively examine the use of Robomind to enhance Computational thinking in learning programming. This analysis expanded all research from 2010 to 2020 were identified by utilising the similarities visualisation software (Vosviewer). A sum of 152 publications was analysed as documented in the Scopus database in november 2021, identified the most compelling subjects covered by the journal. Findings demonstrate several significant research concerns ("Robotics programming" AND "Computational thinking"). Additionally, this analysis presents a roadmap for this reearch, concentrating on critical areas where success is possible.

Keyeords: Robomind, Computational, Learning Programming, Abiblometric Analysis

Introduction

This research quantitatively analyzes Robotics programming and computational thinking publications published between (2010-2020) to examine the research landscape comprehensively, particularly Robotics programming using Bibliometrics analysis. Bibliometrics analysis is a statistical method for quantifying and assessing the number of rising trends in a specific study area (Hao et al., 2018; Chen et al., 2018b, 2019c). Bibliometrics analysis has been employed to assess academic outputs of numerous study disciplines (e.g., Chen et al., 2018a, 2019b). In addition, they have been intended for the assessment of educational study disciplines. For instance, based upon 3914 Publications that were gathered from the Web of Science (WoS), Song et al (2019) systematically analyzed the intellectual structure, trends, and status of online learning settings dialogue study by spotting the top journals as well as contributors, as well as illustrating the scientific associations. Chen et al (2020b) similarly examined research papers in Computers and Education from a quantitative perspective regarding scientific collaborations, author profiles, and research topics.

This review is being carried out based upon the following purposes. First, Robotics programming has evolved into a compelling research area with growing research numbers. Thus, it is required to investigate the thematic structure of such a study area by utilizing an accurate machine learning method that could spontaneously examine sizeable, documented

literature data. Then, the current research is being carried out to help provide insights concerning what has been discussed and the trends in the field of Robotics programming. Such an objective is achieved by assessing the changes in significant relevant prominence patterns and the growing research areas. Additionally, implications and insights associated with the future studies performed by our analyses are intuitive in helping researchers with decision-making regarding research types in the fields to focus on.

Research Objective

For this purpose, the objectives of this study are to analyze online learning publications indexed in Scopus by using bibliometrics and visualization analysis. Moreover, in the current analysis, all data have been collected from Scopus, the world's leading abstract and citation database of peer-reviewed research. Therefore, this research data included a different range of resources of leading journals in education technology. This analysis allowed us to see how the research interests of Robotics programming have been altered over time. Additionally, this research also visualized and investigated the scientific collaborations among top contributors in online education that were unavailable in prior studies.

Research Methodology

This review aims to reveal the profile of the studies conducted for Robotics programming for period of (2010-2020). To achieve this aim, a bibliometric and visualisation methods were used together in the study, this study followed previous studies that used biblometric analysis for instance (Van et al., 2021; Abuhassna et al., 2022). Moreover, Bibliometric analysis is based on following the studies on a specific subject and revealing the findings by analysing these studies according to various characteristics (Marti-Parreno et al., 2016). Relevant publications in the Scopus database were included in the study to reach high-quality articles, excluding any conferences or proceedings. In the scan conducted on 17/11/2021, key words were searched in the title, summary, or keyword sections by selecting the “Topic” option. Among the articles obtained after the search, English and open access articles were included in the study. “Robomind programming” and “computational thinking” have been used as keywords and phrases that evoke them. Scopus has been used to obtain Robomind programming journals in this research since it includes intelligent tools to visualise, analyse, and track study output in different areas such as humanities, technology, and science (Agapiou and Lysandrou, 2015; Tober, 2011).

Additionally, to guarantee the relative significance of the analysed publications to Robomind programming, the researcher carried out manual screening to exclude irrelevant publications following the criteria shown in Table 1

Table 1
Inclusion and exclusion criteria

Inclusion criteria	Robomind programming
	Computational Thinking
	Learning programming
Exclusion criteria	Not being used in the education context
	Not focused on online learning education
	Conference papers, proceedings papers, nonindexed publications.

In this manner, 152 publications remained for additional analysis. Exclusion and inclusion criteria are presented in Table 1. In addition, the analytic research framework is illustrated in figure 1

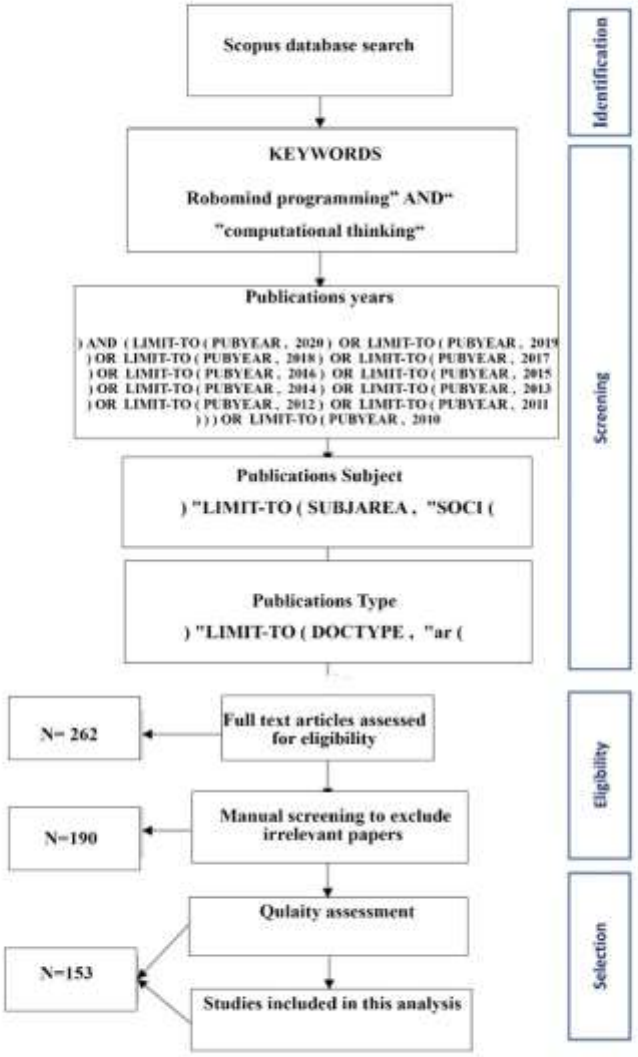

Figure 1: The analytic research framework

Research Findings

The bibliometric analysis method was used in the study. With bibliometric analysis, the most commonly used keywords, the most cited journals, the most published journals, the journals that published the most studies on the subject, the countries that did the most studies on the subject, the publication cooperation between countries, the keywords used and the relationship between them, the most cited authors, the relationship between the authors, the journals that were jointly cited and the most published areas were examined. The VOSViewer software, which is one of the widely used programs in the visualization of bibliometric networks (Artsın, 2020), was used to reveal the network visualization in the analysis.

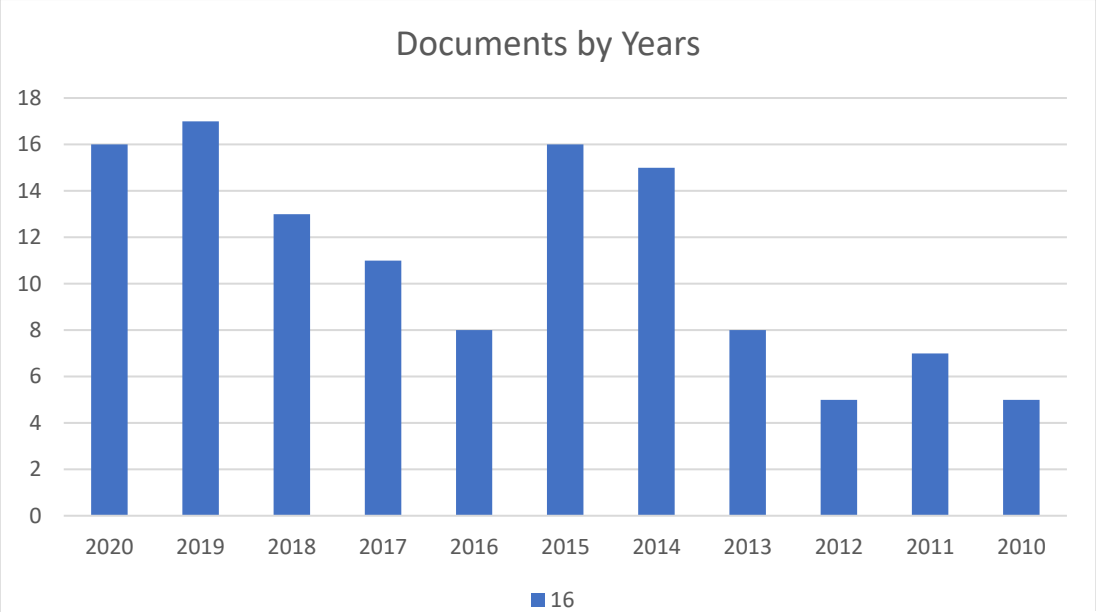

Figure 2: Distribution of publications by years (2010-2020)

Figure 2 illustrates the first finding addressed within the context of content analysis is the publication year of the articles through the last decade. It was seen that the articles were mainly published in the last couple of years, in the year 2020, a total number of 16 publications were published in relation to Robomind programming" and "computational thinking", in the year 2019 a total number of 17 publications were published, following by a total number of 13 publications in the year of 2018, and the other publications were distributed for the rest of the years as shown in figure 2. Beginning With the analysis of the yearly distribution of Robomind programming" and "computational thinking" publications, it is worth mention that the study on Robomind programming" and "computational thinking" has obtained a dramatic increase in concern from scholars, demonstrating a promising growth trend.

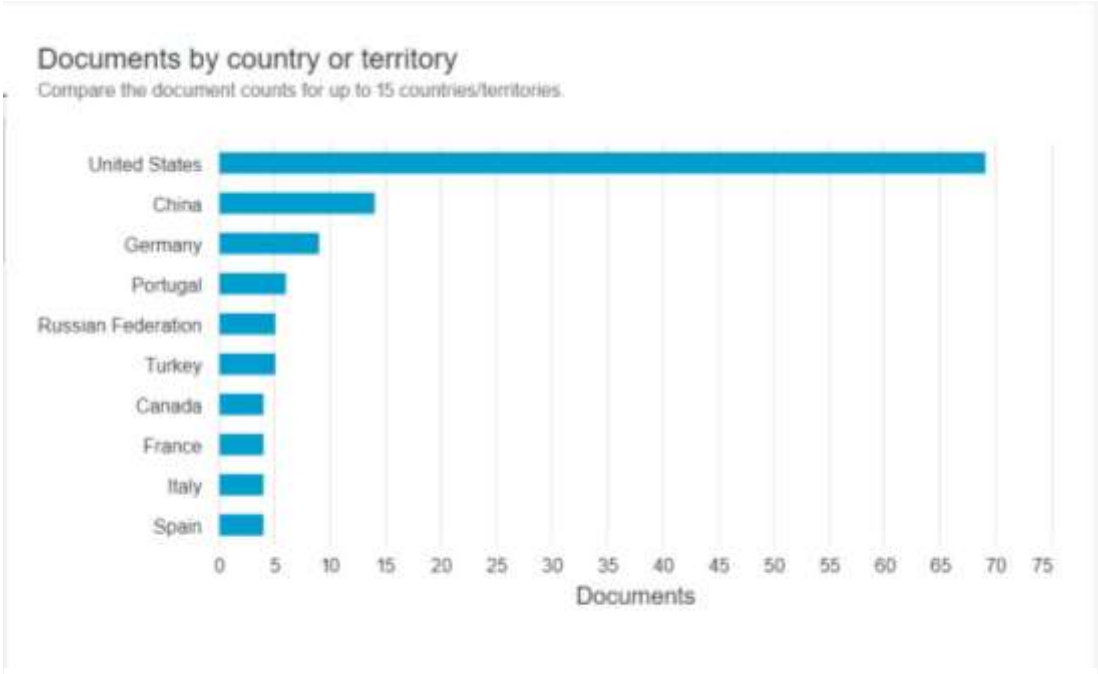

Figure 3: Distribution of publications by Countries

Figure 3 show the most 10 productive countries in Robomind programming and computational thinking research area, illustrate the topic distributions of the leading prolific countries/regions and establishments. From a country standpoint, the vast majority of the listed countries/regions demonstrated a stable interest in all the research matters relating to Robomind programming and computational thinking, while various countries/ regions demonstrated a specific interest in specific trends. E.g., the most productive country was "United States" with a total number of publications of 69, within the Duquesne University, Pittsburgh. Followed by "China"with a total number of publications of 14. Followed by "Germany" with a total number of publications of 8, within the Royal Melbourne Institute of Technology (RMIT University). Moreover, other prolific productive countries in Robomind programming and computational thinking research area research area data are presented in figure 4

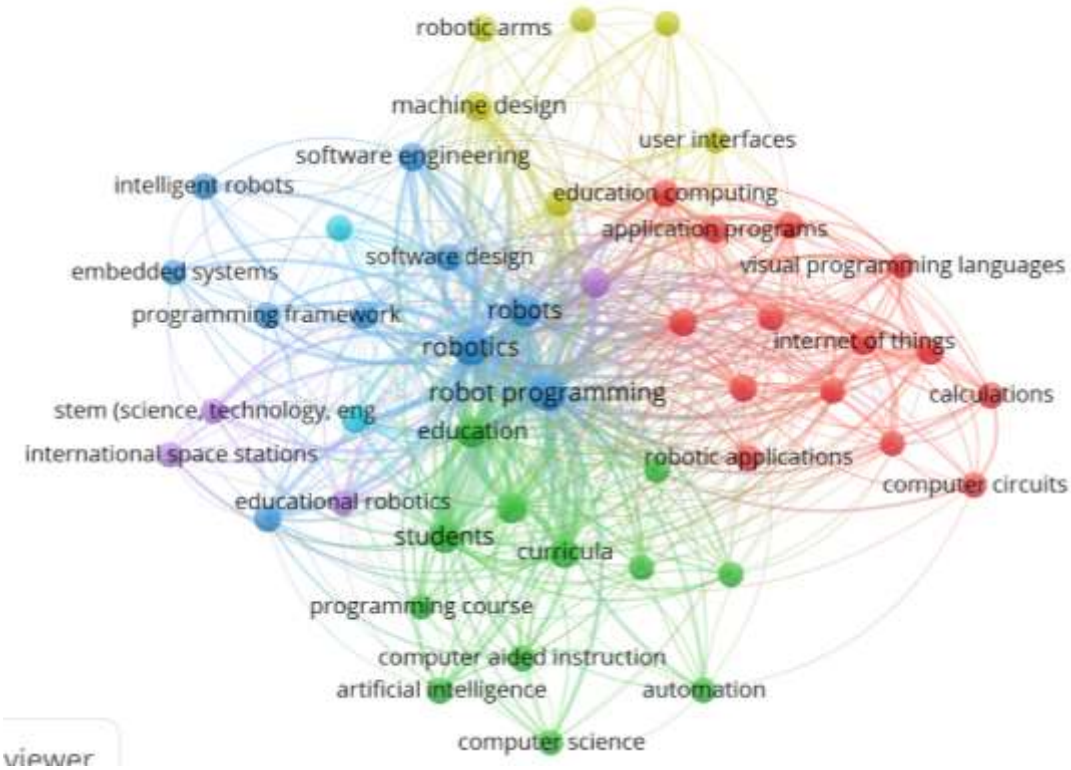

Figure 4: Distribution of indexed keywords

Figure 4 presents a summary of the most frequent keywords with a minimum of 5 occurrences, wherein the highest keyword occurrence is robot programming. Followed by Robotics, education computing, Robotics applications. Moreover, the most frequent keywords are presented in figure 2.5.

Table 2
Most recent publications in Robomind programming and computational thinking

Authors	Objectives	Results
Cakıroglu & Kilic (2020)	This study deals with suggesting a course model including data collection tools for evaluating teachers' pedagogical content knowledge in teaching computational thinking via teaching robot programming.	The results provide implications for educators who desire to provide training programs for teachers to prepare them to teach robotics.
Alvarez- (2020)	Educational robotics, programming and computational thinking are being incorporated in the classrooms of many educational centres and at any age.	The results show that although there is a high percentage of considering floor robots as an excellent tool for the development of computational thinking in Early Childhood Education.
Zhong et al (2020)	This study examined the effects of virtual and physical robots (VPR) using in different learning stages (simple session/complex session) in a robotics programming course.	Results showed that no significant difference was found in the students' learning attitude, programming skills, and learning engagement between VPR and PR.
Ponce et al (2022)	This work proposes the use of robotic platforms inside elementary schools and universities to improve and evaluate the usability and effectiveness of robots on students' attention spans, motivation, and knowledge acquirement during their classes.	The results showed that the use of a robotic platform in class helps the students improve their knowledge acquisition and increases their motivation and attention span.
Wang et al (2019)	This Paper discusses a coding/programming academy that used games and robotic programming as engaging hands-on approaches to teach 6th grade (the first grade in secondary education in USA) females coding/programming concepts to increase their knowledge and interest in computer science. computer science.	It describes how the academy was organized and taught, which includes a brief description of the instructional materials, the concepts taught in each hands-on session, how the academy was assessed and the assessment results, and the first-year experience of conducting the coding/programming academy, and lessons learned.
Nusayr & Silva (2019)	The use of robotics and robot design programming was viewed to be strictly used in the domain of higher education.	In this paper we show a case study on how robotic programming camps for teens helped shape their ideas in the computer science

		field and engage students in programming interest.
Díaz-Lauzurica & Moreno-Salinas 2019)	In the present work, a practical experience about how to teach CT using robotics is developed, showing the results and evaluation of the lessons on robotics taught to students in their 4th year of compulsory secondary education, and where the students showed a high degree of apathy and demotivation	The results show that the pedagogical techniques, instruments, and evaluation were adequate to increase the motivation of the students and to obtain a significant learning.
Karaahme & Korkmaz (2019)	The aim of this study is to investigate the effects of project-based arduino educational robot applications on students' computational thinking skills and their perception of Stem skill levels.	At the end of the research, it was determined that activities based on block based robotic programming tool did not have a significant effect on both students' total scores of Stem skills and scores related to factors.
Kucuk & Sisman (2018)	The aim of this study was to reveal pre-service teachers' experiences in learning robotics design and programming.	Three themes were identified in this study: Course process, professional development, and teaching children. The pre-service teachers indicated that they found opportunities to learn by doing and experience, enjoyed doing robotics activities and felt in flow in this process.
Ohnishi et al (2017)	The objective of this study is to evaluate the effectiveness of robots in teaching programming to children.	This research studies robotics classes for elementary and junior high school students. The tasks set for the robots used in each class are familiar to children, and they were set with the aim of inspiring a proactive learning attitude in the children.
Witherspoe t al (2017)	This study measures pre/post gains with new computational thinking assessments given to middle school students who participated in a virtual robotics programming curriculum.	The success of this intervention suggests that participation in a scaffolded programming curriculum, within the context of virtual robotics, supports the development of generalizable computational thinking knowledge and skills that are associated with increased problem-solving performance on nonrobotics computing tasks.

Chen et al (2017)	Based on a framework of computational thinking (CT) adapted from Computer Science Teacher Association's standards, an instrument was developed to assess fifth grade students' CT.	Results show that the instrument has good psychometric properties and has the potential to reveal student learning challenges and growth in terms of CT.
Chou & Su (2017)	This study aimed to investigate how elementary school students used Arduino-based educational robotics to support their electrical engineering learning.	A preliminary analytical result indicated that the educational robotics were effective instructional tools to teach varied types of engineering concepts. In addition, Students might increase their systematic thinking, problem solving, and logical thinking skills during robotics programming

Table 2.5 presents the most recent publications in Robomind programming and computational thinking. Çakıroğlu & Kiliç (2020) study deals with suggesting a course model including data collection tools for evaluating teachers'pedagogical content knowledge in teaching computational thinking via teaching robot programming. The results provide implications for educators who desire to provide training programs to officers to prepare them to teach robotics. Using the suggested model, the instructional activities and the assessment tools are structured for practitioners' use.

Findings of the Study

Alvarez-(2020) studied educational robotics, programming and computational thinking are being incorporated in the classrooms of many educational centres and at any age. To verify if this is so, 50 experts (active teachers, trainers of future teachers and commercial technicians of educational robotics) from all over Spain were tested. The results show that although there is a high percentage of considering floor robots as an excellent tool for developing computational thinking in Early Childhood Education, there is no consensus when using other types of practices that go beyond and benefit this learning process. Zhong et al. (2020) examined the effects of virtual and physical robots (VPR) using in different learning stages (simple session/complex session) in a robotics programming course.

Results showed no significant difference in the students'' learning attitude, programming skills, and learning engagement between VPR and PR. In contrast, significant differences existed in engineering design ability and cognitive load. In complex or straightforward learning, complex or detailed unique advantages facilitate students'' higher order thinking in solving a complex problem and reducing their cognitive load. Ponce et al (2019) in his work proposes using robotic platforms inside elementary schools and universities to improve and evaluate the usability and effectiveness of robots on students'' attention spans, motivation, and knowledge acquirement during their classes. The results showed that using a robotic platform in the category helps the students improve their knowledge acquisition and increases their motivation and attention span. Also, the surveys and usability analysis demonstrate that the design of the diligence and course projects were sufficient to generate greater interest among the students in the topics taught in school. Wang et al (2019) discusses a coding/programming academy that used games and robotic programming as engaging

hands-on approaches to teach 6th grade (the first grade in secondary education in the USA) females coding/programming concepts to increase their knowledge and interest in computer science. Computer science. This paper describes the organization, coordination, content, and assessment of the coding/programming academy. It explains how the academy was organized and taught, including a brief description of the instructional materials, the concepts taught in each hands-on session, how it was assessed and the assessment results, and the first-year experience of conducting the coding/programming academy and lessons learned. Nusayr & Silva (2019) studied the use of robotics and robot design programming was viewed to be strictly used in the domain of higher education. The advances in engineering and the lowered hardware cost made acquiring and building a robot easier for a person to get started in robotic education. This paper shows a case study on how robotic programming camps for teens helped shape their ideas in the computer science field and engage students in programming interests. Diaz-Lauzurica & Moreno-Salinas (2019) In his work, a practical experience about how to teach CT using robotics is developed, showing the results and evaluation of the lessons on robotics taught to students in their 4th year of compulsory secondary education, and where the students showed a high degree of apathy and demotivation. The results show that the pedagogical techniques, instruments, and evaluation were adequate to increase the motivation of the students and to obtain significant learning, showing how the teaching of CT may attract students that have lost interest and motivation while providing them with abilities that essential for the learning throughout life. Witherspo & Schunn (2019) aims to understand whether the various instructional goals teachers'' hold when using these curricula may offer one potential explanation for disparities in outcomes. The findings provide evidence that despite using the same curriculum, students showed differential learning gains on the CT assessment when in classrooms with teachers who rated CT as a more critical instructional goal; these effects were powerful for women.

Conclusion of the Study

The present review tried to map a knowledge base to investigate the most recent studies in robomind programming and its relation to computational thinking using bibliometric and content analysis through bibliometric analysis of 262 found in the initial search in Scopus database for the bibliometric analysis. Moreover, after carrying out manual screening to exclude irrelevant publications per the criteria, a total of 192 papers has been extracted from the Scopus database. We carried out A quality assessment after analyzing documents abstracts; 153 articles were left to examine in this paper between 2010 and 2020. A bibliometric mapping is designed to focus on illustrating tendencies in knowledge construction instead of research results synthesizing. Consequently, the current review ensured the necessity for research reviews that look at the study’s results concerning the in robomind programming and its relation to computational thinking. This review has not reviewed all publications related to in robomind programming and its relation to computational thinking. This review used only the Scopus database since the Scopus database has a large body of publications.

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