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The review of NAO robotics in Educational 2014-2020 in COVID-19 Virus (Pandemic Era): technologies, type of application, advantage, disadvantage and motivation

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Abstract

The use of robotics in education is a very important issue for disposal and galaxies in this era of the pandemic (COVID-19). Where this study examines the topic of robotics in education (RIE) by using modern and specific query methods extracted from different research sites and based on judicious scholar's standards. These sites are Web of Science, Taylor and Francis and Science Direct. After careful investigation and deep research, the following titles should be taken which are (a) Educational robots, (b) education in robots, (c) human-robot interaction, (d) Higher Education, (e) academic, (f) smart pedagogy, (j) student, and (h) tutors. The retrieved articles were filtered according to the Use of robotics in Education. A total of 98 articles were selected and examined. Finally, we examined the taxonomy of these articles of robotics in Education base on faith and guidance, according to specific criteria, into six groups, which include Faith and Guidance, Concepts, Device, Application, Manufacturing, Studies Analysis and educational. Therefore, this work will be the platform and the guide for student, researcher, educators, anyone how interest in this field. The current focus in this area is on employing papers containing NAO robots and that 17 articles.

Keywords

Education in robots, NAO robot, academic, student, smart pedagogy.



Introduction

At the end of 2019, the pandemic COVID-19 virus appeared in some countries of the world and spread rapidly to most countries in the world at the beginning of 2020. One of the affected field which is the education has led to the closure of thousands of schools and universities all over the world and resorted to the shift towards online delivery of education due to the necessity of continuing the academic curriculum and filling any semester gap that may result from the exacerbation of the crisis in the whole world.

The use of NAO robot which is a small, humanoid robot for people to communicate with and packed with sensors, capable of mimicking human-like activity such as doing a specific task, recognizing faces and objects is used throughout the world in research, academics, industries and many more. As such in the field of education, NAO robot is normally used to provides therapy [1], medical fences [2], observation [3], classrooms activities [4,5,6,8] and public spaces activities [7].

This usage of NAO robot leads to the questions on why and how NAO is effectively used in delivering education especially in where the student-teacher relationship is crucial in every classroom. Furthermore, there will be a question on any resolution or law that supports the disruption of how the knowledge is disseminated by the presence of the NAO robot.

This paper is organized as following with first presenting the related works focusing on robotics in education. Then, unfolds the method used based on the eligibility criteria are discussed along with the taxonomy. Results are also presented together with discussions and conclusions.

Motivation

Through reviewing the literature, it was confirmed that most of the motives are based on looking at the possibility of how NAO robot can be used as part of disseminating knowledge through factors such as games, applications, monitoring and others. Since the pandemic encourages us to be socially distance, these works look at the positive sides of the future in education.

Method

The method of reviewing this topic is proposed with the first step where duplicate articles were collected and identified relevancy based on publications within the past 6 years. Next, articles are sorted according to the titles, abstracts, and keywords within the domain. The articles are filtered by excluding articles out the scope of the domain that does not meet the criteria of the topic, as shown in Fig.1. The same eligibility criteria were applied in all three steps.

The search was conducted on accredited scientific research engines content to the Web of Science (WoS), Scopus, Taylor & Francis, science direct and IEEE Xplore from 2014 to Mid-2020. A mix of keywords in different forms was used, such as ‘education in robots’, ‘human-robot interaction’, ‘higher education’, ‘academic’, ‘smart pedagogy’, ‘teachers’ and ‘student’, Combined with the ‘OR’ and ‘AND’ operators followed by ‘academic’, ‘smart pedagogy’, ‘teachers’ and ‘student’, or combined with the ‘OR’ and ‘AND’ operators followed by ‘tutors’. The explicit query text is shown at the top of Fig.1 (step one) we used other additional options and in the search engines of the five databases and some paper in the chapters of books and accurate words reports. We omitted journals and conference papers because we saw these two sources as being the most likely to provide up-to-date and acceptable research work applicable to our survey. Eligibility criteria the articles shown in Fig.1 which met our criteria were included in our work. The initial goal was to map the field of research into a general and coarse-grained taxonomy. This study focused on a category of the second stage is device include sensor and NAO robot.

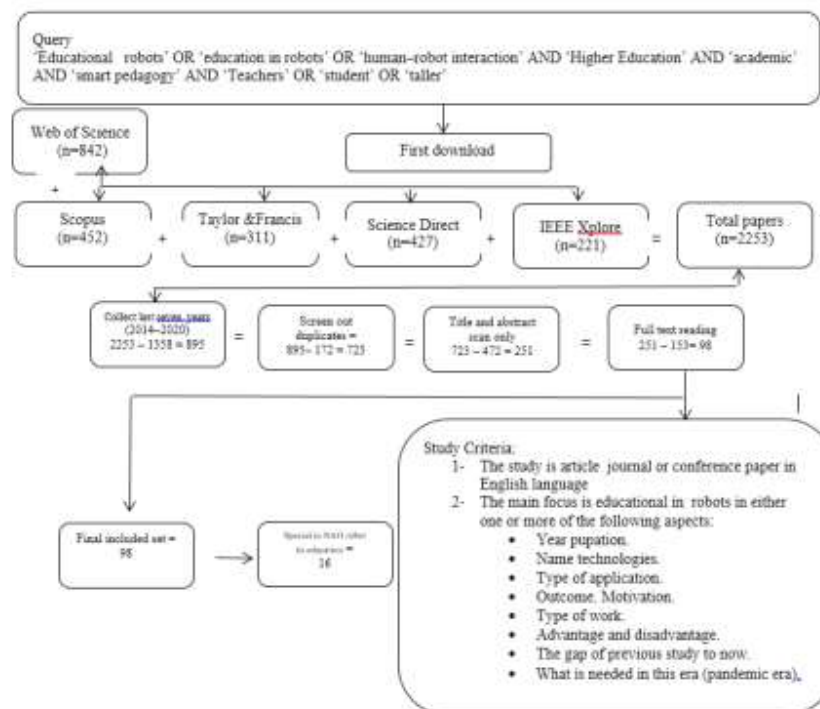


Fig.1 Flowchart diagram Study Query words used & Criteria

Criteria of Study

The articles shown in Fig. 1 which met our criteria were its part of our work. Its initial objective was to map the research scope of general, coarse-grained taxonomy consists of six categories derived from a previous study of the literature with no restrictions. After removing duplicate papers between databases, we excluded the articles through three iterations of filtering and screening when the articles did not meet our eligibility criteria. Our work focuses on concepts robots, Device, application robot, manufacturing robot, studies analysis robot, educational and NAO robot of education in robots, as shown in Fig. 2.

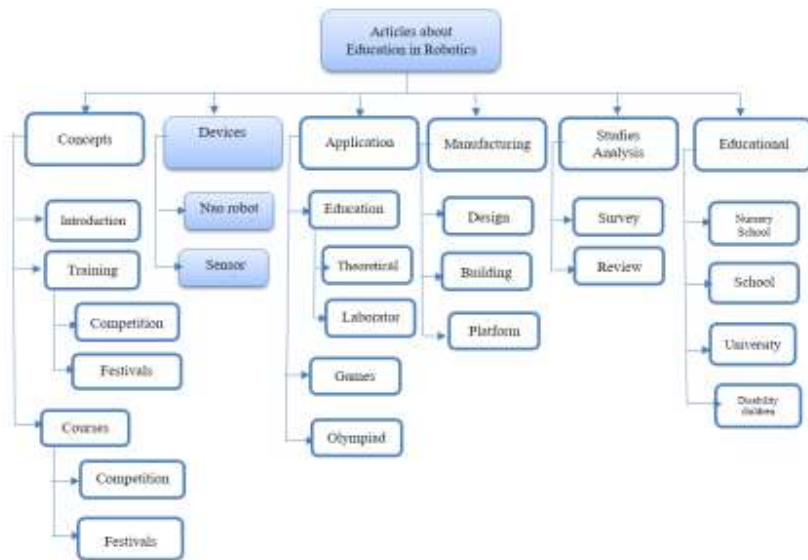


Fig. 2 first Taxonomy of Study articles on robotic education.

Data collection process and taxonomy

Data were collected from the five scientific sites mentioned in the summary and protected through the authors' accounts. After that, the initial screening process was performed and included three stages (1) Screen out duplicates, (2) Title and abstract scan and (3) Full-text reading, however ultimate, Articles have been read, analyzed and summed up according to content, its initial categories As well summarized and making charts at Word, Excel and EndNote library. All research papers were two stages of taxonomy the first. Taxonomy into six categories included concepts robots, device, application robot, manufacturing robot, studies analysis robot, and educational. Second stages are devices consists of sensors and NAO robot. The NAO robot consists of studies analysis, application and educational, as shown in Fig. 3. The current focus in this area is on employing papers containing NAO robots and that 17 articles. Divided into three categories used of technologies; type of application; and advantage and disadvantage.

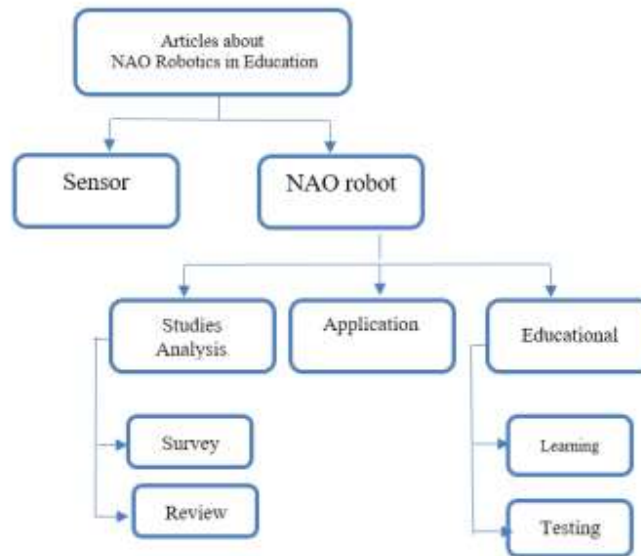


Fig. 3 Second Taxonomy of Study articles on Nao robotic in education.

Result

The search in education in the robot, used query of 2253 articles follows 842 articles from Web of Science, 452 articles from Scopus, 311 articles from Taylor & Francis, 452 articles from Science Direct and 221 articles from IEEE Xplore from 2014 to Mid - 2020. The items were filtered according to the sequence adopted in this investigation and Use of two types of 895 previously written articles six and half years (2014-2020) and 172 papers were published in all three databases which led to 723 papers. After a full session screening of the titles and abstracts, 427 more papers were ruled out. After the final, 153 papers were ruled out Reading full text. The final set was made up of 98 papers, they were split into six big groups which were divided into six major categories, including Educational, Concepts, Device, Application, Manufacturing and Studies of Analysis.

The first category, which contained 22 articles (22.44%), was Educational and had four sections disability children, Nursery School, School, disability children and University, the second category, which contained 19 articles (19.38%), was Concepts, Parts included Introduction, training and courses (Competition, Festivals), the third category, which contained 6

articles (6.12%), was application, Parts included Education (Theoretical Laboratory), Games and Olympiad, the fourth category, which contained 23 articles (23.46%), was manufacturing, Parts included Design, Building and platform, the Fifth category, which contained 12 articles (12.44%), were studies analysis parts included survey and review and the last category, which contained 17 articles (14.28%), was Devices, Parts included sensor and NAO robot, as shown in Fig.2. This study focused on a category of the second stage is device include sensor and NAO robot consist of Studies analysis parts included survey and review; application; and education. Which contained 1 article (5.88%), was the sensor. which contained 16 articles (94.11%), was NAO robot, Parts included Studies analysis parts included survey and review; application; and education. which contained 3 articles (18.75%), was studies analysis, Parts included survey and review. which contained 13 articles (81.25%), was application; and education.

The following Study Criteria were applied to all research articles:

The main focus is educational in NAO robots in either one or more of the following aspects:

- Year pupation.
- Name technologies.
- Type of application.
- Method
- Outcome.
- Motivation.
- Type of work.
- Advantage and disadvantage.
- The study from 2014 until now.
- What is needed in this era? (The pandemic era).

The explanation in detail will depend on the six categories of articles extracted from the query shown in the Fig.1.

Sensors

The researchers present a study about RGB-D which used in teaching. The article includes a course project on humanoid robotics is presented. The task combines teleportation with an integrated programming framework. The approach used in the article is building a PBL-based learning approach using Humanoids know the learning objectives and give a description of the practical and theoretical aspects of the project students solve problems independently and analyze them.

Concludes promote the spread of educational robots in all schools at all levels the student relied on recording their opinions and observations, teaching on the discussion, and asking questions. Represent our addition to their work. a) our aim for the future is to extend the teaching system Novel sensors and functionalities used. b) Training the student.[9] The human-like configuration of humanoid robots makes them capable of carrying out different duties[10]. Next category is about studies analysis survey and review article as shown in Table 1 with Application and Educational articles Category is shown in Table 2.

Studies analysis survey and review article

Table.1 A Comparison Between Technologies Depends on Details Article Including the Type of Application and

No.	Ref	Year	Name technologies	Type of application	Method	Motivation	Type of work/ study
1	[11]	2019	Identify how robotic technology.	applied in classrooms on different educational levels and subjects	Analysis	study of the robot-learner interaction time dimension	Applied
2	[7]	2018	Novel technologies: artificial intelligence or machine learning	NAO +Pepper robot	designing social robot interactions	searching articles + the main trends	Applied
3	[12]	2016	More refined data analysis techniques	assessing integration methods +the effectiveness of educational robotics on student learning	a) integration of robots to support teaching in classrooms b) the ZPD theory with NAO's	a) Real-World Interaction Analysis b) learning analytics to directly focus on interaction + conversation dynamics	Pilot

Methods in Studies Analysis Article.

Application and educational article.

Table.2 A Comparison Between Technologies Depends on Details Article Include the Type of Application and Methods in Application and Educational Articles.

No.	Ref	Year	Name technologies	Type of application	Method	Motivation	Type of work/ study
1	[2]	2020	A Finite State Machine (FSM) architecture	NAO robot + EMG sensor known as Myo Armband	TCP client + C++ Moy arm-band SDK +Python NAO robot SDK	Learning + Patient support	Under development
2	[13]	2019	Confirmatory factor analysis CFA and SEM technology	unified theory of acceptance and use of technology (UTAUT) model+ NAO device	predicted +social influence+ effort expectancy+ performance expectancy	acceptance of robot-mediated teaching +therapy for children	Applied
3	[5]	2019	Program for International Student Assessment (PISA)	NAO robot	Electroencephalogram (EEG) readings	observe levels of attention + monitored+body language analysis	Experimental protocol
4	[14]	2020	Questionnaires	elicitation a concept for programming an application + the NAO robot	Tests + exercises with the robot and Python	provide possible STEM education	Applied

5	[1]	2014	Robot Operating System (ROS)	NAO robot has arms	speech-based teleportation (in Basque) and gesture-based	Movement +transport	Proposal
6	[15]	2016	Students apply the knowledge	Metabotix project: Teaching Robotics Programming for girls	EV3 and NXT Lego Mindstorms	interest in STEM (science, technology, engineering and mathematics) areas	Applied
7	[10]	2016	Systematic and hierarchical music-based scenario	ASD's improvement in motor+communication + learning music.	NAO robot to play the xylophone and the drum.	Learning + play + Treatment	Applied
8	[16]	2019	Softbank Robotics humanoid platform	NAO robot has 25 degrees of freedom (DoF), seven touch sensors, four directional microphones, two speakers, speech recognition capability , four sonars, two 2D cameras+ Python and C++	Platform within the Choregraphe user Environment.	Speech recognition capability + facial	Applied
9	[6]	2018	Platform of IFLYTEK to NAO robot	NAO can be programmed under Linux, Windows and Max OS X operating Systems, supporting C++, Python, C# and net frameworks.	designs the program of the voice dialogue database between college instructor and student	introduces the speech recognition +synthesis technology	Applied
11	[17]	2015	NAO robot	Q&A sessions +Python, C++ or Java code	progress test + NAO V5 Evolution	Learning Design+ Innovation teaching	Pilot study
12	[18]	2019	NAO robot	Microsoft DigiSpark outreach project	approach of teaching secure coding and ethical hacking through hands-on exercises with NAO	Learning robotics+ cyber security,	Experiential learning
13	[3]	2019	NAO robot	Influence and control the morality and behavior of the students via their presence.	Design + comparison is nao able to deter students from cheating with teacher and without teacher.	Invigilator + Learning	Empirical study
14	[19]	2017	RoboCroc. + RoboMonkey	Animal-like robots	Inquiry +design of robot behaviors	Learning	Applied

Distribution results

In Fig. 4, shows that many papers were published by the four digital databases. The devices consist of Sensor and NAO robot, The NAO robot consist of studies analysis, application and education. Web of Science published 6 papers, IEEE Xplore published 4 papers, Scopus published 4 papers, and Science Direct published 3 papers as shown in Fig.4

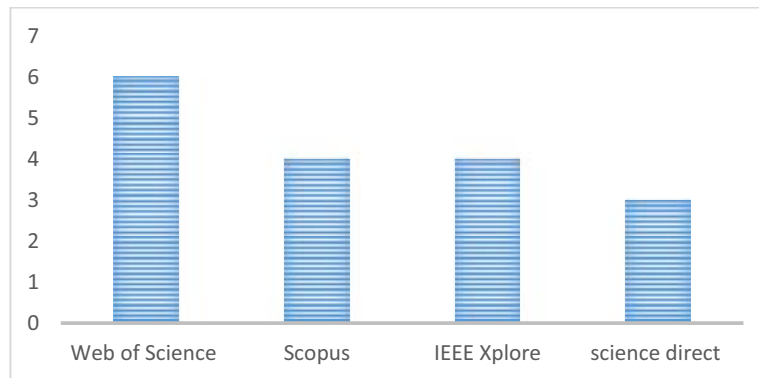


Fig. 4 publishing sites by numbers.

Distribution by publication years of articles

Distribution by publication years of articles from 2014 to 2020 is shown below. Nearly one paper has been published since 2014. One paper was published in 2015. Three papers have been published since 2016. One paper has been published since 2017, two since 2018, five since 2019, and three since 2020 to May month, as shows as in Fig.5.

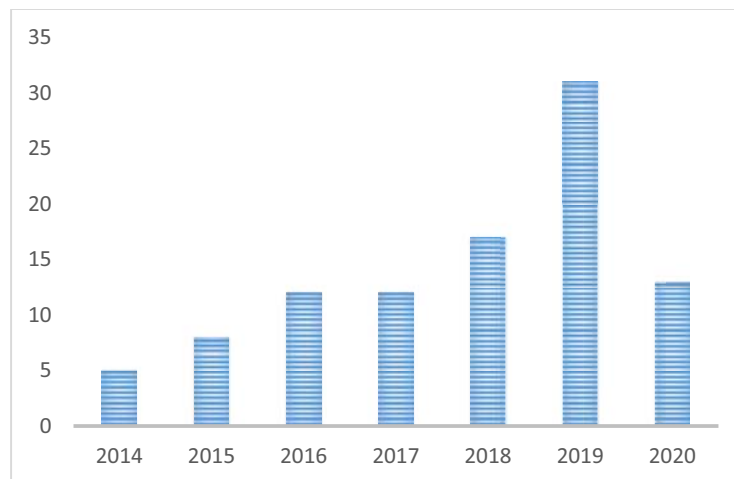


Fig. 5 Statistics of the included papers in different categories by publication year.

Distribution by nationality of the author

In Fig 6, shows that 17 countries and nationalities implemented triage. We observed that the literature studies were conducted in certain countries or they covered cases in these countries. The nationality distribution of the 17 paper in NAO robotics in Education papers in numbers and percentages shows that the most productive authors are from the Pakistan, Poland, Mexico, Slovenia, Germany, Spain, Brazil, Iran, China, Israel and Italy (1each). Australia, USA and Malaysia (2 each).

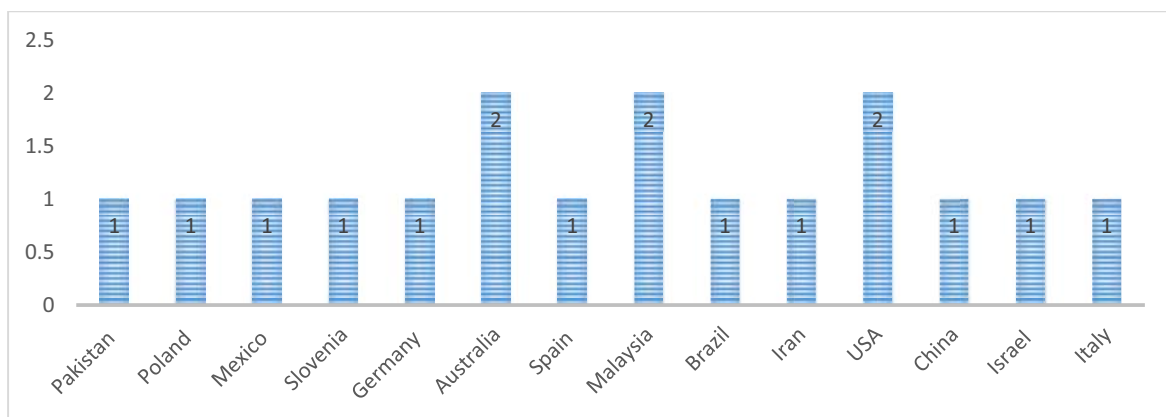


Fig. 6 Nationality of Author.

Challenges

The main purpose of this study is to eliminate the challenges and obstacles facing education in an age of chronic disease and any future accidents which are the reliance on robotic education and the interface of the study several challenges including quarantine time all over the world and especially Malaysia and the difficulty of movement and mobility COVID-19 Virus (Pandemic Era):

1. Focusing on entry a robot with learning.
2. Proposal to approach the government agencies for accreditation or entering it with education in kindergartens, schools, institutes and universities
3. Eliminate the literacy of education, e-education and automated education.

Advantage and Disadvantage

The advantage for studies is the participation of all sexes in teaching and getting rid of isolation women, especially in the Pandemic era. Its application reduces cases of infection with Crohn virus in the era of the bizarre. Explanation of educational and medical lectures by a robot in the era of the pandemic, as well as can be used in the future for physical therapy. Education in building safe coding and ethical hacking. Design a framework for introducing NAO educational program based on a larger scale of experimental research. The aim for the future is to extend the teaching system. Novel sensors and functionalities used and training the student. The disadvantage Lack of education and training courses on the uses and skills of the novels in learning and the lack of adoption of a law or government legislation to introduce it in education or its adoption.

Conclusion

Here is the important point of our study that focused on how to insert a robot to be an alternative or assistant teacher in giving lectures and observation the student during the lecture and at the time of the exam and entering laboratories and doing experiments and entering the classes And follow-up activities and events, delivery of duties, giving and checking attendance and clouds for students And give degrees and distinction between the lazy student and the smart student. This study sought to prepare a study in the past six years (six and have because study expired in May 2020), (2014–2020) and the need for the meeting to continue teaching and not stop at the age of the epidemic of (COVID-19).

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