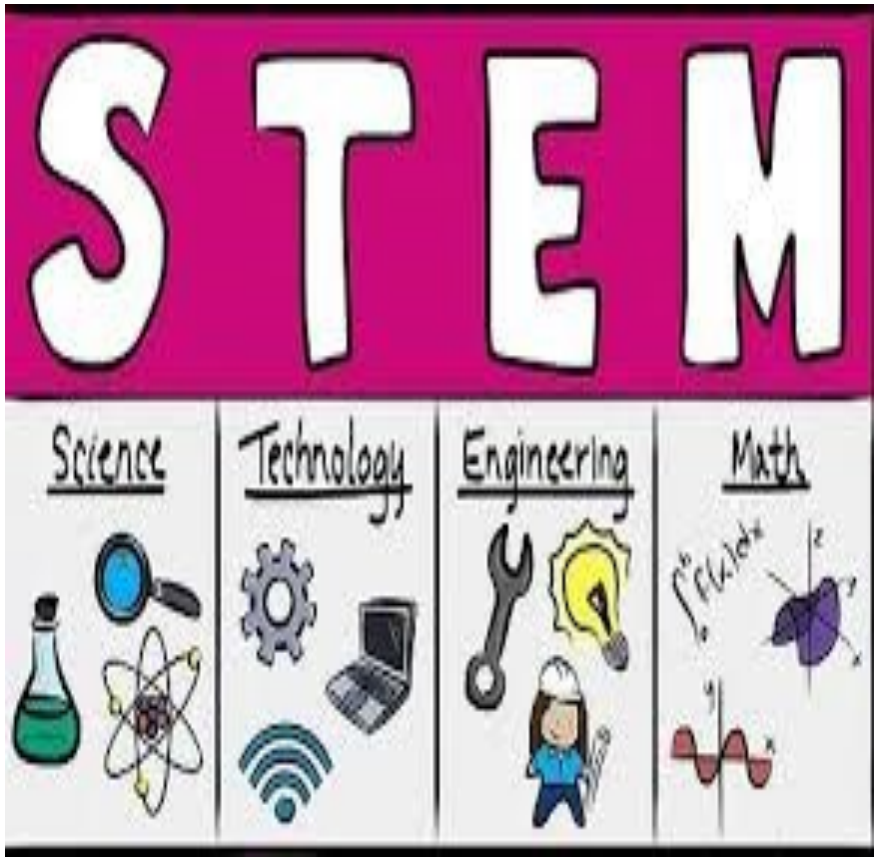
STEM ROBOTICS CURRICULA BIBLIOGRAPHY



https://www.skillrobotics.com/about-us

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Compiled by Edna Böhmer, November 2019

Attending to structural programming features predicts differences in learning and motivation. / Eben B. Witherspoon, Christian D. Schunn, Ross M. Higashi and Robin Shoop. 26 Mei 2017 11 Pages

http://www.lrdc.pitt.edu/schunn/papers/witherspoonetal-JCAL.pdf

Abstract

Educational robotics programs offer an engaging opportunity to potentially teach core computer science concepts and practices in K–12 classrooms. Here, we test the effects of units with different programming content within a virtual robotics context on both learning gains and motivational changes in middle school (6th–8th grade) robotics classrooms. Significant learning gains were found overall, particularly for groups introduced to content involving program flow, the structural logic of program execution. Relative gains for these groups were particularly high on items that require the transfer of knowledge to dissimilar contexts. Reaching units that included program flow content was also associated with greater maintenance of programming interest when compared with other units. Therefore, our results suggest that explicit instruction in the structural logic of programming may develop deeper transferrable programming knowledge and prevent declines in some motivational factors.

Beyond Coding: Back to the Future with Education Robots.

2018 35 Pages

http://www.roamer-educational-robot.com/wp-content/uploads/videos/PDFFiles/BeyondCodingBacktotheFuturewithEducationRobots.pdf

Abstract

Jeannette Wing's 2013 call for education to make coding a key skill coincided with a boom in new education robots. Not surprisingly most of these new robots focus on developing student's computational thinking abilities and programming know-how. Is that all robots can offer? To find the answer we'll explore the history of education robots: specifically the ideas of Seymour Papert. What we'll find is something with far more potential than providing learners with a way of developing their coding skills. And against accepted wisdom, I'll suggest that as technology develops the need for coders will (in the long-term) dwindle but the power of robots to help educate children for the future will increase.

A Brave New World :Technology & Education. / OECD.

2018 12 Pages

https://www.oecd.org/education/ceri/Spotlight-15-A-Brave-New-World-Technology-and-Education.pdf

Classroom teachers were also interviewed and asked to complete anonymous pre and post surveys. Results from this study provide preliminary evidence that PreKindergarten children can design, build, and program a robot after just one week of concentrated robotics work.

Additionally, results indicate that teachers were able to successfully integrate robotics work into their classrooms that included foundational math and literacy concepts while also engaging children in the arts. However, this study also highlights the difficulties and challenges that must be considered before implementing a robotics curriculum into a PreKindergarten classroom, including opportunities for one-to-one adult assistance during building and programming activities.

The Wheels on the Bot go Round and Round : Robotics Curriculum in Pre-Kindergarten. / Amanda Sullivan, Elizabeth R. Kazakoff and Marina Umashi Bers. 2013 17 Pages

http://www.jite.informingscience.org/documents/Vol12/JITEv12IIPp203-219Sullivan1257.pdf

Executive Summary
This paper qualitatively examines the implementation of an intensive weeklong robotics curriculum in three Pre-Kindergarten classrooms (N=37) at an early childhood STEM (science, technology, engineering, and math) focused magnet school in the Harlem area of New York City. Children at the school spent one week participating in computer programming activities using a developmentally appropriate tangible programming language called CHERP, which is specifically designed to program a robot's behaviors. The children used CHERP to program "Robot Recyclers" that they constructed using parts from LEGO® Education WeDo™ Robotics Construction Sets. The Robot Recyclers were designed to help carry, push, and/or sort recyclable materials found in the classroom. Researchers were participant-observers in the robotics lessons over the course of curriculum implementation. Each lesson was taught by the researchers, with classroom teachers present in order to facilitate classroom management and assist with small group work. A combination of interviews, video, photographs, and classroom observations were used to document the students' experiences.

Introduction
Rapid technological advances can have an impact on personal, social and professional development. Implications for education include changes in the demand for knowledge and skills as well as expanding possibilities for teaching and learning.

C-STEM Girls Computing and Robotics Leadership Camp. / Sruti Modekurty, Judy Fong and UC Davis. 15-18 June 2014 14 Pages

https://c-stem.ucdavis.edu/wp-content/uploads/Articles/ASEE_WIED_paper_published.pdf

Abstract
In the summer of 2013, the UC Davis C-STEM Center hosted a one-week Girls Computing and Robotics Leadership Camp for 14 middle school girls from the greater Sacramento region. This camp set out to motivate girls to learn science, technology, engineering, and math (STEM) concepts through a fun and exciting robotics-based curriculum. Emerging as leaders, the participants inspire other young girls to gain interest in science and technology. Three college female students led the camp with the help of six high school female student assistant coaches. Through this experience the 14 girls learned the basics of robotics, principles of engineering, and essentials of C/C++ programming. In addition, they learned important life skills including teamwork, presentation skills, leadership skills, self-assurance, and breaking gender stereotypes.
Women professionals in various science and engineering fields also met and discussed with the participants helping them visualize a future career in STEM and gain exposure to the variety of options available to them. As a culminating project the girls who participated in the camp created multi-media video presentations with robotics, similar to the RoboPlay Video Competition, and made presentations in front of parents and peers. The girls were given robotics kits to take back to their middle schools so they can start computing and robotics clubs of their own. Coaches and assistant coaches continue to mentor girls over the academic school year to facilitate the development of these clubs and their participation in RoboPlay Competition.

Challenges in STEM learning in Australian schools : literature and policy review. / Michael Timms, Kathryn Moyle, Paul Weldon and Pru Mitchell. 2018 35 Pages

https://research.acer.edu.au/cgi/viewcontent.cgi?article=1028&context=policy_analysis_misc

Charting a course for success: America's strategy for STEM education ; a report by the Committee on STEM Education of the National Science & Technology Council. December 2018 48 Pages

https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf

Contents

This paper presents a first attempt to develop a concrete definition of ER, which describes all fields of study that constitutes it and how they are related between them. The definition is the result of the experience acquire during the participation of the European project Educational Robotics for STEM (ER4STEM).

Towards a More Responsive STEM education in the Philippines Regional STEM Symposium 2019. / I. A. Victorino 27-30 May 2019 10 Pages

https://events.development.asia/system/files/materials/2019/05/201905-country-presentation-philippines.pdf

Presentation Outline, Department of Education-Bureau of Curriculum Development.

- General Information
- STEM Curriculum K TO 12 Curriculum
- Teacher Training Programs

2016 Massachusetts Science and Technology/Engineering Curriculum Framework April 2016. / Massachusetts Department of Elementary and Secondary Education. 2016 198 Pages

http://www.doe.mass.edu/frameworks/scitech/2016-04.pdf

Commissioner's Foreword

Acknowledgments

The subject of Robotics becomes part of the Primary school curricula for all the five years of formation. The program has allowed the teachers training and a complete way through which children have demonstrated great learning abilities, not only in mere technology but also in collaboration and teamwork.

Teachers' perceptions of using robotics in primary/elementary schools in Newfoundland and Labrador. / Ahmad Khanlari. June 2014 117 Pages

https://pdfs.semanticscholar.org/01f0/0ff19676581a58ec0045d327dcc567f03c41.pdf

Abstract

Robotics, with its multidisciplinary nature, integrates Science, Technology, Engineering, and Mathematics (STEM) disciplines and is considered a gateway to STEM education. This study aims to understand whether primary/elementary teachers perceive robotics as a useful tool for STEM education or not. This study also seeks to better understand primary/elementary teachers' perceptions of the barriers of using robotics and the support that they need. A sample of 11 primary/elementary teachers from Newfoundland and Labrador English Schools District (NLESD) participated in this study. The results of this study revealed that the participants perceive robotics to have the potential to facilitate learning of primary/elementary science and technology-related topics, while they do not perceive robotics to be a useful tool for learning mathematics. The participants also perceived robotics to have positive effects on students' lifelong learning skills. Furthermore, the participants indicated a number of barriers to integrate robotics into their teaching activities and expressed the supports that they need.

Towards a Definition of Educational Robotics. / Julian M. Angel-Fernandez & Markus Vincze. 2018 6 Pages

https://www.uibk.ac.at/iup/buch_pdfs/robotics_workshop_2018/10.152033187-22-1-08.pdf

Abstract

There is an increasing number of articles, web pages, robotic kits and other materials that are using the term Educational Robotics (ER) to refer to the use of robots in education, however the current definition of ER is still vague and open to misinterpretation. Therefore, anyone can claim that their work falls in the category of ER just because robots are involved. Despite all benefits of robotics, its incorrect use may be counterproductive. Therefore, the incremental use of the term ER is meaningless if it is not used correctly. Consequently, a concrete and precise definition of ER is required to support the development of it.

Classroom Robotics and Acquisition of 21st Century Competencies: An Action Research Study of Nine Ontario School Boards. / Janice Aurini, John McLevey, Allyson Stokes and Rob Gorbet. 23 August 2017 45 Pages

https://ontariodirectors.ca/CODE-rob/Robotics_Final_Report_Sept_22_2017.pdf

Contents

Coding and Computational Thinking. What is the Evidence? / NSW Government. 2018 44 Pages

https://education.nsw.gov.au/our-priorities/innovate-for-the-future/education-for-a-changing-world/media/documents/future-frontiers-education-for-an-ai-world/Coding-and-Computational-Report_A.pdf

Overview

This report has been commissioned by the NSW Department of Education's Education for a Changing World initiative.

It investigates the available evidence on the teaching of coding and computational thinking for student outcomes and explores and critiques what works in the implementation of coding and computational thinking within an educational context.

Systematic Review of Research Trends in Robotics Education for Young Children. / Sung Eun Jung and Eun-sok Won. 21 March 2018 24 Pages

file:///C:/Users/51790335/Downloads/sustainability-10-00905%20(1).pdf

Abstract

This study conducted a systematic and thematic review on existing literature in robotics education using robotics kits (not social robots) for young children (Pre-K and kindergarten through 5th grade). This study investigated: (1) the definition of robotics education; (2) thematic patterns of key findings; and (3) theoretical and methodological traits. The results of the review present a limitation of previous research in that it has focused on robotics education only as an instrumental means to support other subjects or STEM education. This study identifies that the findings of the existing research are weighted toward outcome-focused research.

Lastly, this study addresses the fact that most of the existing studies used constructivist and constructionist frameworks not only to design and implement robotics curricula but also to analyze young children's engagement in robotics education. Relying on the findings of the review, this study suggests clarifying and specifying robotics-intensified knowledge, skills, and attitudes in defining robotics education in connection to computer science education. In addition, this study concludes that research agendas need to be diversified and the diversity of research participants needs to be broadened.

To do this, this study suggests employing social and cultural theoretical frameworks and critical analytical lenses by considering children's
historical, cultural, social, and institutional contexts in understanding young children's engagement in robotics education.

Teaching robotics at the primary school: an innovative approach. / Abdel Rahim El Mouhamad. [2014] 10 Pages

file:///C:/Users/51790335/Downloads/Teaching_Robotics_at_the_Primary_School_An_Innovat.pdf

Abstract

Many researchers and teachers agree that the inclusion of Science, Technology, Engineering, and Math in early education provides a strong motivation and a great improvement in learning speed. Most curricula in primary schools include a number of concepts that cover science and math, but less effort is applied in teaching problem solving, computer science, technology and robotics.

The use of robotic systems and the introduction of Robotics as a curricula subject can bring the possibility of transmit to children the basics of technology and to give them other kind of human and organizational values.

STEM school education interventions : synthesis report. / Education Council June 2019 40 Pages
http://www.educationcouncil.edu.au/site/DefaultSite/filesystem/documents/Reports%20and%20publications/Publications/STEM%20Education%20Initiatives%20Synthesis%20Report.pdf
Contents
Introduction
Background
Definitions
Overview of STEM Education in Australian Schools
Sources of funding and policy direction for STEM school education
Issues in STEM education
Current STEM initiatives of evaluated STEM initiatives
Evaluations of STEM School Interventions
Key characteristics of the initiatives
Findings and analysis
Conclusion
Appendix A: Summary of nominated school STEM initiative
Appendix B: Summary of evaluations of school STEM initiatives

STEM teaching and learning in the Toronto District School Board : towards a Strong Theoretical Foundation and Scaling Up from Initial Implementation of the K-12 STEM Strategy Research Series I.
June 2016 203 Pages
https://www.tdsb.on.ca/Portals/research/docs/reports/TDSBSTEMStrategyResearchRpt1.pdf
Executive summary
The goal of the Toronto District School Board's (TDSB) Science, Technology, Engineering and Mathematics (STEM) Strategy is to provide professional learning (PL)1 opportunities and build capacity among TDSB Kindergarten to Grade 12 (K-12) teachers to enhance their STEM pedagogical knowledge, self-efficacy to teach STEM, and promote STEM implementation in classrooms. At the end of the first year of implementation of the TDSB STEM professional learning initiative, our research revealed important findings about administrator, teacher, coach, and student attitudes towards STEM education, STEM teaching and learning practices, and STEM Professional learning practices. In particular, the findings provided insights into administrator and teacher perceptions of the value of STEM education; teacher knowledge of STEM pedagogy, resources, STEM careers, and collaboration in Professional Learning Communities (PLCs); teacher confidence and self-efficacy in STEM teaching; the frequency of use of STEM teaching practices to develop STEM competencies in students; student perceptions of teacher practices promoting STEM competencies; and teacher, administrator, and coach perceptions of the professional learning support provided.

Coding as a playground: Promoting positive learning experiences in childhood classrooms. / Marina U. Bersa , Carina González-Gonzálezb and M. Belén Armas–Torresb 2019 16 Pages
https://sites.tufts.edu/devtech/files/2019/05/1-s2.0-S0360131519300995-main-1.pdf
Abstract
In recent years, there has been a push to introduce coding and computational thinking in early childhood education, and robotics is an excellent tool to achieve this. However, the integration of these fundamental skills into formal and official curriculums is still a challenge and educators need pedagogical perspectives to properly integrate robotics, coding and computational thinking concepts into their classrooms. Thus, this study evaluates a "coding as a playground" experience in keeping with the Positive Technological Development (PTD) framework with the KIBO robotics kit, specially designed for young children. The research was conducted with preschool children aged 3–5 years old (N = 172) from three Spanish early childhood centers with different socio-economic characteristics and teachers of 16 classes. Results confirm that it is possible to start teaching this new literacy very early (at 3 years old). Furthermore, the results show that the strategies used promoted communication, collaboration and creativity in the classroom settings. The teachers also exhibited autonomy and confidence to integrate coding and computational thinking into their formal curricular activities, connecting concepts with art, music and social studies. Through the evidence found in this study, this research contributes with examples of effective strategies to introduce robotics, coding and computational thinking into early childhood classrooms.

Computing in the national curriculum. A guide for secondary teachers.
2014 34 Pages
https://www.computingatschool.org.uk/data/uploads/cas_secondary.pdf
Partial Introduction
The new national curriculum for computing has been developed to equip young people in England with the foundational skills, knowledge and understanding of computing they will need for the rest of their lives. Through the new programme of study for computing, they will learn how computers and computer systems work, they will design and build programs, they will develop their ideas using technology, and create a range of digital content.

Developing Computational Thinking in Compulsory Education : Implications for policy and practice. 2016 68 Pages
https://publications.jrc.ec.europa.eu/repository/bitstream/JRC104188/jrc104188_computhinkreport.pdf

Abstract

In the past decade, Computational Thinking (CT) and related concepts (e.g. coding, programing, algorithmic thinking) have received increasing attention in the educational field. This has given rise to a large amount of academic and grey literature, and also numerous public and private implementation initiatives. Despite this widespread interest, successful CT integration in compulsory education still faces unresolved issues and challenges. This report provides a comprehensive overview of CT skills for schoolchildren, encompassing recent research findings and initiatives at grassroots and policy levels. It also offers a better understanding of the core concepts and attributes of CT and its potential for compulsory education. The study adopts a mostly qualitative approach that comprises extensive desk research, a survey of Ministries of Education and semi-structured interviews, which provide insights from experts, practitioners and policy makers. The report discusses the most significant CT developments for compulsory education in Europe and provides a comprehensive synthesis of evidence, including implications for policy and practice

But what does all this mean in practice for secondary schools? How should school leaders be planning for the new curriculum and how can teachers develop the additional skills they will need? What qualifications routes are available to computing students at KS4 and where might they lead?

This guide has been written especially for secondary teachers. It aims to demystify precise but perhaps unfamiliar language used in the programme of study. It will enable teachers to get to grips with the new requirements quickly and to build on current practice. It includes help for schools with planning and gives guidance on how best to develop teachers' skills.

Development of a 4th-8th Grade Curriculum for Flying and Programming Mini Drones. / Jordan Lynn Bartholomew and Russell Scott Mayo. 2018 68 Pages

https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=2225&context=gradreports

Abstract

This project was a joint effort by Jordan Bartholomew and Russell Mayo. The project consisted of three parts. Part one was the development of the lesson content led by Jordan Bartholomew. Part two was the production of a multimedia package that included lesson videos, animations and logos for the ROAV copter mini curriculum, led by Russell Mayo. Part three included a journal article to introduce the curriculum co-written by both Jordan and Russ. The curriculum was developed for hands-on experiential learning and includes a computational thinking component. The lesson videos were intended for self-instruction or in a classroom setting.

Conclusion
References

STEM EDUCATION POLICY STATEMENT 2017-2026. 27th November 2017

28 Pages

https://www.education.ie/en/The-Education-System/STEM-Education-Policy/stem-education-policy-statement-2017-2026-.pdf

CONTENTS

STEM Magazine : Robotics for K-5. June 2018 36 Pages

http://www.stemmagazine.com/gwpvJmcx18/9EB16DD5058A68AE0A6EFF73EA2E88E6/gJUNE18.pdf

STEM Magazine is a monthly subscription non-profit education publication for educators, students, their parents and industry professionals. Read monthly in 67 countries, STEM Magazines strive to encourage the educator to better understand the importance of STEM skills, their use in every school subject, the need and ease of integration into curriculum and the urgency for students to embrace STEM.

STEM education for all young Australians A Bright Spots STEM Learning Hub Foundation Paper, for SVA, in partnership with Samsung. / STEM Education Research Centre (SERC). 2017 47 Pages
https://www.socialventures.com.au/assets/STEM-education-for-all-young-Australians-Smaller.pdf
Contents

The curriculum was piloted with elementary and middle school students. This project documents the curriculum and journal article. This project will be submitted individually by each author for their master's plan-B project.

Development of Computational Thinking Skills through Educational Robotics. / Vaso Constantinou and Andri Ioannou. [2018?] 11 Pages
http://ceur-ws.org/Vol-2193/paper9.pdf
Abstract
Computational thinking (CT) is an important concept in modern education. The scientific community is not only investigating the skills involved in CT but, is also trying to establish how these skills can be developed and through what technological means. Meanwhile, a few studies have investigated the effectiveness of educational robotics (ER) as technological means which can support the development of CT but, issues of measurement of CT (i.e., using validated instruments) seem to hinder the validity of these investigations. In this paper, two quasi-experimental studies were conducted to address students' CT gains linked to their participation in ER activities. The first study was conducted at a primary school in the Eastern Mediterranean; 15 consented students participated in ER activities for five weeks.
The second study included 16 students in a secondary school in the same region, who participated in ER activities for three months. Quantitative results, based on a valid measure of CT, showed that the students who participated in the ER interventions demonstrated significant improvement in their CT skills. This study extends the evidence of the potential of using ER to improve students' CT skills in K-12 contexts

DoCENT – Digital Creativity ENhanced in Teacher Education : Framework of Digital Creative Competencies (Version 1.2)
2019 58 Pages
https://docent-project.eu/sites/default/files/2019-03/o1_-_framework_of_digital_creative_teaching_competences_-_v1.2.pdf
Abstract
The first output of the project (O1 - Framework of digital creative teaching competences) aims to define the key components of competences needed by teacher educators for effectively integrating digital creativity in teaching contexts, as well as to provide and validate a EU reference framework for developing and evaluating digital creative teaching competences. The framework of competences targets teacher educators, educational policy makers, as well as EdTech research centres and companies, and indirectly pre-service / in-service teachers. O1 provides a foundation to develop the DoCENT MOOC (O2) and Serious Game (O3).

The first section presents the main concepts around digital creativity as applied to education. Section 2 reviews European policies in relation to the integration of digital technologies and creativity in ITE systems. The third section draws up DoCENT pedagogical framework, i.e. it defines the project training approach, and the conceptual dimensions addressed. Section 4 defines the methodology employed to design the DoCENT competence framework. Section 5 reports a desktop study on ITE systems in Greece, Italy and Spain. Finally, Section 6 presents the prototype model of the competence framework.

An educational robotics activity to promote gender equality in stem education. / Laura Screpanti, Lorenzo Cesaretti, Elisa Mazzieri, Laura Marchetti, Angelica Baione and David Scaradozzi. 2017 11 Pages

http://www.icicte.org/assets/8.4_screpanti_cesaretti_mazzieri_marchetti_baione_-scaradozzi.pdf

Abstract

In the future boys and girls will be employed in, and maybe create, new jobs connected with technology. We present a project whose aim was to raise interest in STEM education in K12 students and, in particular, to address the lack of participation of female students in STEM careers. For this reason, in September 2017, 20 students (12 girls and 8 boys) took part in a two-weeks robotic camp to learn robotics and its application on agriculture. An evaluation of attitudes and performances was accomplished by delivering a questionnaire and by recording the results from day-to-day challenges.

Educational Robotics as an Innovative Educational Technology. / Elena Ospennikovaa, Michael Ershovb and Ivan Iljin. 15 - 18 June 2015 9 Pages

file:///C:/Users/51790335/Downloads/educational-robotics-as-an-inovative-educational-technology%20(2).pdf

Abstract

The problem of introducing the educational robotics into practical work of Russian secondary schools has been analyzed. Preferential development of technical creativity of students in robotics is pointed out in additional education system. The practice of introducing robotics into the academic process is still at the initial stage of its development and is not always efficient. In this study, educational robotics is considered as an element of polytechnic orientation of the academic process. The possibility of its use as a special educational technology in classes on subjects of science and math cycle is substantiated. Three areas of professional work of the teacher are distinguished in the structure of the technology: robotics as an object of study, as a tool of cognition and as a means of teaching, development and upbringing of students. The paper reveals the activity of the teacher in each direction.

Schools of the future : Highlights. / Oueensland Government**.**

1 November 2019 1 Page

https://advancingeducation.qld.gov.au/our-plan/schools-of-the-future

Website information

Success in a changing world requires students to have the skills to participate in a knowledge-based economy. That's why we are focusing on engaging young Queenslanders in science, technology, engineering and mathematics (STEM). A building block to this future is the literacy of coding which has become the new literacy and a 'must have' for every student.

Key highlights to be progressed include: fast-tracking the Digital Technologies curriculum including coding and roboticsestablishing STEM virtual academies, including a specialist coding academyincubating the next generation of IT entrepreneurs.

To learn more about our exciting initiatives, view the Advancing education action plan (PDF, 2.2MB).

To learn more about the state schools' STEM strategy, view the STEM animation and supporting plan (PDF, 660KB).

To learn more about coding and robotics, view the #codingcounts animation and supporting plan (PDF, 579KB).

STEM Education: a review of the contribution of the disciplines of science, technology, engineering and mathematics. / Christine v. Mcdonald. 2016 40 Pages

http://www.icaseonline.net/sei/december2016/p4.pdf

Abstract

Recent global educational initiatives and reforms have focused on increasing the number of students pursuing STEM subjects, and ensuring students are well-prepared, and suitably qualified to engage in STEM careers.

This paper examines the contributions of the four disciplines - Science, Technology, Engineering and Mathematics - to the field of STEM education, and discusses STEM literacy; factors influencing students' engagement in STEM education; effective pedagogical practices, and their influence on student learning and achievement in STEM; and the role of the teacher in STEM education. Through a critical review of 237 studies, three key factors were identified: (1) the importance of focusing on the junior secondary phase of schooling to maintain student interest and motivation to engage in STEM, (2) the implementation of effective pedagogical practices to increase student interest and motivation, develop 21st century competencies, and improve student achievement, and (3) the development of high-quality teachers to positively affect students' attitudes and motivation towards STEM.

Robotics in the classroom : The effectiveness of robotics based curriculum in STEM education. / Mark Nall. 2016 54 Pages

https://pdfs.semanticscholar.org/82cd/9e9a5cf5fa15762491927a4dd6df64e0a453.pdf

Abstract

Students learn best when they are engaged and are able to interact with their Environment. They can build their own definition of concepts and themes, which are more meaningful because they are related to their own experiences and memories (Kolb, 1984). Simply put it all comes down to constructivism, which means a person builds knowledge and meaning from interactions between their experiences and ideas (the environment they work/play in and the people and objects they interact with). The purpose of this study is to find out how a middle school and high school constructivist robotics curriculum impacts students' conceptual understanding of electrical circuit concepts.

Robotics in the early childhood classroom : learning outcomes from an 8-week robotics curriculum in pre-kindergarten through second grade. / Amanda Sullivan, Elizabeth R. Kazakoff, and Marina Umaschi Bers. 9 March 2015 18 Pages

https://sites.tufts.edu/devtech/files/2018/02/robotics-paper.pdf

Abstract

In recent years there has been an increasing focus on the missing ''T'' of technology and ''E'' of engineering in early childhood STEM (science, technology, engineering, mathematics) curricula. Robotics offers a playful and tangible way for children to engage with both T and E concepts during their foundational early childhood years. This study looks at N = 60 children in pre-kindergarten through second grade who completed an 8-week robotics curriculum in their classrooms using the KIWI robotics kit combined with a tangible programming language. Children were assessed on their knowledge of foundational robotics and programming concepts upon completion of the curriculum. Results show that beginning in pre-kindergarten, children were able to master basic robotics and programming skills, while the older children were able to master increasingly complex concepts using the same robotics kit in the same amount of time. Implications for developmentally appropriate design of technology, as well as structure and pace of robotics curricula for young children are addressed.

SA develops coding, robotics curricula for grade R-9. 2019 1 Page

http://www.ngopulse.org/article/2019/03/14/sa-develops-coding-robotics-curricula-grade-r-9 The SA Government is developing a curricula for coding and robotics for grades R to 9.

The results of teaching experience of the authors related to the application of this technology in teaching physics are presented.

Educational robots in primary school teachers' and students' opinion about STEM education for young learners. / Eugenia Smyrnova-Trybulska , Nataliia Morze , Piet Kommers , Wojciech Zuziak and Mariia Gladun. 2016 8 Pages

https://files.eric.ed.gov/fulltext/ED571601.pdf

Abstract

The article discusses issues related to STEM education; it is emphasized that the need to prepare students with twenty-first-century skills through STEM-related teaching is strong, especially at the elementary level.
The authors stress that workshops, using kits to build and program robots, are a modern form of interdisciplinary education of children and youth. The rationale for conducting such activities in schools is found in the European reference framework in the context of training of key competences. Classes in robotics – properly taught – will have an impact on the development of mathematical literacy and scientific-technical information and social competences. At the same time, competence is understood to mean a combination of knowledge, skills and attitudes appropriate to the situation. Besides, an analysis is presented of basic legal regulations in this matter as well as some results of a survey, conducted in Poland and Ukraine among in-service teachers and prospective teachers.

Educational Robotics Is a Useful Tool in Education. / A David Scaradozzia, Laura Sorbia, Anna Pedalea, Mariantonietta Valzanoc , and Cinzia Verginec. April 2019 14 Pages

file:///C:/Users/51790335/Downloads/roboticsineducation.pdf

Abstract

In the contemporary educational system, the inclusion of educational robotics in the curriculum of schools has been controversial. The research paper argues for the integration of educational robotics in curriculum of schools. The purpose is to encourage educators and schools to integrate educational robotics in their curriculum to create a useful learning environment for students to exhibit their knowledge and develop the important skills needed for their futures. The paper offers three grounds: educational robotics provides an effective learning tool for students in various fields as math, physics, and biology (STEM); educational robotics improves students' communication, collaboration, and teamwork skills; educational robotics creates a fun and engaging learning environment for students. These grounds argue against schools that refuse to insert the educational robotics in their curriculum because of the time needed for educational robotics and of the high cost for it.

Data was collected from resources that provided approaches and studies, which teachers and schools can benefit from it to know the importance of educational robotics. In conclusion, educational robotics is a useful learning tool for students, so it should be a crucial part in the curriculum of each school.

The Effect of a Classroom-Based Intensive Robotics and Programming Workshop on Sequencing Ability in Early Childhood. / Elizabeth R. Kazakoff , Amanda Sullivan and Marina U. Bers 2012 11 Pages
https://ase.tufts.edu/devtech/publications/kazakoffsullivanbers.pdf
Abstract
This paper examines the impact of programming robots on sequencing ability during a 1-week intensive robotics workshop at an early childhood STEM magnet school in the Harlem area of New York City. Children participated in computer programming activities using a developmentally appropriate tangible programming language CHERP, specifically designed to program a robot's behaviors. The study assessed 27 participants' sequencing skills before and after the programming and robotics curricular intervention using a picture-story sequencing task and compared those skills to a control group. Pre-test and post-test scores were compared using a paired sample t test. The group of children who participated in the 1-week robotics and programming workshop experienced significant increases in post-test compared to pre-test sequencing scores.

The effects of a robotics program on students skills in STEM, problem solving and teamwork. / Kaye R. Ebelt. 2012 60 Pages
https://scholarworks.montana.edu/xmlui/bitstream/handle/1/1216/EbeltK0812.pdf
Abstract
In this action research project a fifth grade robotics program was studied to determine student attitudes towards science, technology, engineering, math (STEM), problem solving and teamwork. The goal of the study was to determine the effectiveness of an after school robotics program. At the conclusion of the study, the research indicated an increased interest in STEM education, greater appreciation for teamwork and more positive attitude towards problem solving.

An exploratory study of a robotics educational platform on stem career interests in middle school students. / T.B. Hinton. 2017 158 Pages
https://ir.ua.edu/bitstream/handle/123456789/3271/file_1.pdf?sequence=1
Abstract
With the large expected growth in STEM-related careers in American industries, there are not enough graduates to fill these positions (United States Department of Labor, 2015).

Recent efforts in the domain have attempted to define computational thinking beyond "just programming", articulate its relevance in school learning, and investigate the type of curricula - such as game design and robotics - that help promote its development.
Recent scholarly work also suggests the development of a computational thinking "language" in children as an essential step in the process. This paper reports the findings of an exploratory, descriptive, mixed methods study conducted during a week-long Robotics and Engineering workshop that used a pre-post interview design to measure elements and dimensions of computational thinking verbally expressed by children.
The purpose of this paper is two-fold: first, to unpack key elements of the Australian Curriculum: Technologies in order to support teachers and pre- service teachers to implement these components, and second, to describe ways in which teachers can teach authentic integrated STEM education that also provides opportunities for students to develop and demonstrate 21st century competencies.
Based on data collected from projects undertaken in a number of school sites over 18 months, we have developed and share a model for the gradual structured release of teacher control over student activity in STEM activities, and describe how this concept can be a basis for in-situ teacher professional learning. The affordances of robotics and visual programming as a context for integrated STEM education are discussed, and identified as promoting "head-heart-hands" learning.

Robotics as a Learning Tool for Educational Transformation. / Amy Eguchi. 18 July 2014 8 Pages
http://www.terecop.eu/TRTWR-RIE2014/files/00_WFr1/00_WFr1_04.pdf
Abstract
Educational robotics is a transformational tool for learning, computational thinking, coding, and engineering, all increasingly being viewed as critical ingredients of STEM learning in K-12 education. Although robotics in education for school age children has been in existence since the late 1900s and is becoming more popular among young students, it is not well integrated as a technological learning tool in regular school settings. The paper aims to convey the importance of integrating educational robotics as a technological learning tool into regular curriculum for K-12 students and explain how it helps students prepare for the future.

This paper reports a study in which 32 early childhood educators participated in an intensive three-day professional development workshop with the goals of: increasing teachers' knowledge about robotics, engineering and programming, and pedagogies for teaching them in the early childhood classroom. Results show a statistically significant increase in the level of knowledge in all the three areas of technology in general, pedagogy, and robotics content knowledge after participation in the institute. Additionally, results show significant increases in several aspects of technology self-efficacy and attitudes toward technology. Implications for designing effective technology focused professional development are discussed.

Robotics and Discovery Learning : Pedagogical Beliefs, Teacher Practice, and Technology Integration. / Florence R. Sullivan and Mary A. Moriarty. 2009 34 Pages

https://people.umass.edu/florence/jtate.pdf

Conclusion

Finally, in regard to the finding that teachers felt robotics would best be taught in an after-school setting, further investigation is necessary. Teachers may be more willing to alter their pedagogical practice to align with the pedagogical intentions reified in the educational technology product itself if the context of implementation is an informal one. With less at stake, teachers may be more willing to experiment. Future research should explore the contexts in which teachers may be willing to use technologies that stretch their pedagogical practices and interrupts their perceptions about the learning needs of students. When teachers see technology-rich environments— designed to enable open-ended inquiry and self-directed learning— as essential to student learning, such technology may have a chance to be integrated into classrooms.

Robotics and Engineering for Middle and High School Students to Develop Computational Thinking : Paper presented at the Annual Meeting of the American Educational Research Association New Orleans, April 7–11, 2011. / Shuchi Grover. 7-11 April 2011 15 Pages

https://web.stanford.edu/~shuchig/docs/AERA2011-Shuchi%20Grover-Robotics%20and%20Engineering%20for%20Middle%20and%20High%20School%20Students%20to%20Develop%20Computational%20Thinking.pdf

Abstract

"Computational thinking" is increasingly being viewed as an important ingredient of STEM learning in K-12, and a fundamental part of children's analytical ability.

Increased efforts are being made to reform STEM education from early childhood to college level studies, mainly through increased efforts to incorporate new technologies and project-based learning activities (Hegedorn & Purnamasari, 2012) . At the middle school level, a robotics educational platform can be a worthwhile activity that provides hands-on learning as students learn basic programming and engineering skills (Grubbs, 2013). Based on the popularity of LEGO toys, LEGO Education developed an engaging and effective way to learn about computer programming and basic engineering concepts (Welch & Huffman, 2011). LEGO MINDSTORMS offers a project-based learning environment that engages students in real-life, problem-solving challenges.

The purpose of this qualitative study was to investigate the instructional use of a robotics educational curriculum on middle school students' attitudes toward and interests in STEM and their experiences with LEGO Robotics activities. Participants included 23 seventh grade students who were enrolled in a Career Cluster Technologies I class in a suburban middle school. Data for the study were collected from three focus group interviews, open-ended surveys, classroom observations, and the Career Cruising program. Findings revealed that the robotics activities led to an increased interest and higher self-efficacy in STEM tasks. If students continue to nurture and develop their STEM interests, it is possible that many of them may iii develop higher confidence and eventually set personal goals related to STEM classes and careers.

While other studies have been conducted on similar topics, this qualitative research is unique because it contributed to the gap in research that investigates the impact of an in-class robotics curriculum on middle school students' attitudes and interests in STEM. Throughout the robotics unit, students exhibited positive reactions, including much excitement and enjoyment as they solved the robotics challenges. In addition, students demonstrated a greater interest in STEM courses and careers as a result of this hands-on activity. Middle school teachers should incorporate STEM-based activities such as robotics to help students gain hands-on STEM skills

Full STEM Ahead: Afterschool Programs Step Up as Key Partners in STEM Education. / Afterschool Alliance. 2014 22 Pages

http://www.afterschoolalliance.org/aa3pm/STEM.pdf

Contents

Section Four: Recommendations
Resources
References

Gender 4 STEM – Gender aware education and teaching Erasmus+ project – 2017-1-LU01-KA201-023926. December 2017 48 Pages

https://www.gender4stem-project.eu/fileadmin/files/documents/Deliverables/Gender4STEM_O1A1_Synthesis_FINALE.pdf

Intellectual Output 1 - Identifying gender stereotypes and unconscious biases in School Education using collaborative methods O1A1.

Synthesis of gender stereotypes and role-models in STEM education.

ICT in STEM Education - Impacts and Challenges : On Students. A STEM Alliance Literature Review, Brussels, Belgium. 2017 40 Pages

http://www.stemalliance.eu/documents/99712/104016/STEM_Alliance_ict-paper-2-on-students.pdf/8e7898e7-803a-4f2f-b41f-0db684ef3bac

Contents

EXECUTIVE SUMMARY
THE STEM ALLIANCE ICT REPORTS SERIES
- Introduction: Impacts and Challenges
- On Learning Outcomes and Skills
- On Content
- On Axiological Dimensions
- On Gender
- Risks
- Conclusions

REFERENCES
ABOUT STEM ALLIANCE

The Impact of an Integrated Robotics STEM Course with a Sailboat Topic on High School Students' Perceptions of Integrative STEM, Interest, and Career Orientation. / Yiching Chen and Chi-Cheng Chang. 16 July 2018 19 Pages

https://pdfs.semanticscholar.org/b3f4/46d4aacdf54f37bce29afd5bda1aec0448b4.pdf

Abstract

Programming experience promotes higher STEM motivation among first-grade girls. / Allison Master, Sapna Cheryan, Adriana Moscatelli and Andrew N. Meltzoff. 2017 15 Pages

http://ilabs.uw.edu/sites/default/files/17Master_Cheryan_Moscatelli_Meltzoff_STEM_programming_1st%20grade_0.pdf

Abstract

The gender gap in science, technology, engineering, and math (STEM) engagement is large and persistent. This gap is significantly larger in technological fields such as computer science and engineering than in math and science. Gender gaps begin early; young girls report less interest and self-efficacy in technology compared with boys in elementary school. In the current study (N = 96), we assessed 6-year-old children's stereotypes about STEM fields and tested an intervention to develop girls' STEM motivation despite these stereotypes. First-grade children held stereotypes that boys were better than girls at robotics and programming but did not hold these stereotypes about math and science. Girls with stronger stereotypes about robotics and programming reported lower interest and self-efficacy in these domains. We experimentally tested whether positive experience with programming robots would lead to greater interest and self-efficacy among girls despite these stereotypes. Children were randomly assigned either to a treatment group that was given experience in programming a robot using a smartphone or to control groups (no activity or other activity). Girls given programming experience reported higher technology interest and self-efficacy compared with girls without this experience and did not exhibit a significant gender gap relative to boys' interest and self-efficacy. These findings show that children's views mirror current American cultural messages about who excels at computer science and engineering and show the benefit of providing young girls with chances to experience technological activities.

Ready for Robotics: Bringing Together the T and E of STEM in Early Childhood Teacher Education. / Marina Umaschi Bers, Safoura Seddighin and Amanda Sullivan 2013 23 Pages

https://pdfs.semanticscholar.org/3850/1e91278c089369396e99f723701f7be036b8.pdf

Abstract

Prior work has shown that early childhood educators demonstrate a lack of knowledge and understanding about technology and engineering, and about developmentally appropriate pedagogical approaches to bring those disciplines into the classrooms.

Overall, both groups were actively involved and engaged, with the group working with the robot demonstrating a slightly higher depth of knowledge, substantive, conversation, as well as a slight boost in efficacy in math, science, and engineering and technology attitudes. The results of the study align with the underlying conceptual framework as well as the use of authentic assessment. This study aligns to the movement to promote STEM education at an elementary level. In addition, the type of activity associated with this study can potentially help students make sense of career oriented experiences, thus promoting career awareness within an interdisciplinary approach.

New Vision for Education Unlocking the Potential of Technology.

2015 32 Pages

http://www3.weforum.org/docs/WEFUSA_NewVisionforEducation_Report2015.pdf

Contents

Executive summary

The skills needed in the 21st century

The 21st-century skills gap

The potential of technology to help close the skills gap

System-wide priorities for stakeholders Acknowledgements

Definitions of 21st-century skills

The measurement challenge

Indicators considered and used in the report

Countries with available skill data included in the report

A comparison of performance data across tests skill data included in the report

The Next Chapter in the STEM Education Narrative: Using Robotics to Support Programming and Coding. / Susan Blackley and Jennifer Howell.

2019 15 Pages

https://ro.ecu.edu.au/cgi/viewcontent.cgi?article=4108&context=ajte

Abstract

In this paper, we use our qualitative research notes and observations to portray a model for integrated STEM education and summarise primary school students' typical and recurring ways in which they engaged with each new robot.

The robotics curriculum is one of the most common and popular curricula for stimulating students' interest in the science, technology, engineering, and mathematics (STEM) disciplines. The purpose of this study was to develop a robotics curriculum that highly integrates STEM and uses open software and hardware, and to test its effects on high school students' learning outcomes, interest, and perceptions of STEM.

The study involved 82 Grade 10 students; divided into two groups, the experimental group experienced an integrated robotics STEM course, whereas the comparison group participated in a curriculum with commercial robotics.

After a semester, the quantitative and qualitative data showed that the experimental group reported significantly more positive perceptions of integrated STEM, with strengthened knowledge, interest, and career orientation towards related fields. The findings of this study provide suggestions for STEM curriculum development.

Implementing a Robotics Curriculum in an Early Childhood Montessori Classroom. / Mollie Elkin, Amanda Sullivan and Marina Umaschi.

2014 17 Pages

http://www.jite.informingscience.org/documents/Vol13/JITEv13IIPvp153-169Elkin882.pdf

Abstract

This paper explores how robotics can be used as a new educational tool in a Montessori early education classroom. It presents a case study of one early educator's experience of designing and implementing a robotics curriculum integrated with a social science unit in her mixed-age classroom. This teacher had no prior experience using robotics in the classroom beyond a three-day professional development workshop. The case study was constructed by collecting data from surveys, interviews, and a personal blog written by the teacher documenting her experience. The outcome of this research project is a set of suggested criteria for effectively integrating foundational programming and engineering concepts into Montessori early education, based on the inclusion of Montessori tangibles, the need for teacher confidence, and the encouragement of student collaboration.

The Implementation of Integrated Science Technology, Engineering and Mathematics (STEM) Instruction using Robotics in the Middle School Science Classroom. / Celestin Ntemngwa and Steve Oliver.

2018 124 Pages

https://ijemst.net/index.php/ijemst/article/view/426

Abstract

The research study reported here was conducted to investigate the implementation of integrated STEM lessons within courses that have a single subject science focus. The purpose also included development of a pedagogical theory.
This technology-based teaching was conceptualized by school administrators and teachers in order to provide middle school science students with a formal classroom instructional session in which science curricular were modified to include an integrated STEM activity.
To this end, the authors examined and generated an account of the implementation processes including: the nature of the instruction, type of scaffolds, challenges teachers faced, the interaction among teachers, and students and teachers' perceptions of the integrated STEM instruction.
Qualitative data were collected from interviews and classroom observations and then analyzed using grounded theory methods, specifically the constant comparative method.
The results of study showed that teachers required support in the form of an expert technology teacher in order to accomplish a successful classroom implementation of integrated STEM with robotics. Additionally, it was found that teachers did not revise their existing science curriculum but rather selected integrated STEM activities that fit into the overall science course objectives and goals.

INNOVATE A Blueprint for Science, Technology, Engineering, and Mathematics in California Public Education A report by State Superintendent of Public Instruction Tom Torlakson's STEM Task Force. May 2014 52 Pages

https://www.cde.ca.gov/pd/ca/sc/documents/innovate.pdf
Contents

A Multi-Case Study of Student Interactions with Educational Robots and Impact on Science, Technology, Engineering, and Math (STEM) Learning and Attitudes. / Stephanie Kaye Holmquist.

3 April 2014 171 Pages

https://scholarcommons.usf.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=6239&context=etd
Abstract

The demand for STEM trained workers continues to increase not only in the United States, but globally. Reports have indicated that the United States is not doing a good job encouraging students to pursue STEM oriented degrees. In particular, it has become increasingly important to emphasize STEM connections at an early level in order to encourage student career exploration as they continue their education. Educational robots represent a unique alternative to traditional methods, especially at the elementary level. Considering the use of educational robots have largely been ignored at this level, the purpose of this study was to describe the interactive process and outcomes using educational robots to facilitate elementary school students understanding of STEM concepts. A multi-case approach was used for the design as it is in line with the underlying conceptual framework for the study. Independent T-tests were utilized to determine student's interaction with educational robots, impact of STEM understanding, as well as their impact regarding the understanding of STEM attitudes. The study was conducted as an extracurricular program involving fourth grade students at a rural elementary school in Florida.
The sample size consisted of 20 randomly selected participants assigned to either the group working with robots, or the groups without the robots, for a total of 10 participants in each group. The associated activity utilized in this study was selected due to the high level of STEM integration. Data results indicated high levels of interactivity within both groups. The group working with the robot demonstrated a significant difference in the level of substantive talk. Considering the understanding of STEM concepts, both groups demonstrated a high level vii regarding depth of knowledge as well as understanding. There were significant gains within groups regarding pre and post test STEM scores. When considering participants impact on STEM attitudes, the study suggested a practical significance in math attitudes for the group working with the robots. This study is significant as it yielded valuable information concerning the use of educational robots in the elementary environment. In particular, this study supports the idea that STEM concepts can be promoted utilizing authentic instructional strategies. This study suggests there is a potential impact regarding the use of educational robots in the elementary setting. This study also supported the use of authentic assessment strategies for this type of activity.

Lesson 4: Robot Hand (End Effector)
Lesson 5: Robotic Arm and End Effector
Lesson 6: “Out of Sight” – Remote Vehicle
.Lesson 7: Leland and the Robotic Arm
.Lesson 8: Strong-Arm Tactics
.Lesson 9: Robotic Arm
Lesson 10: End Effector
Lesson 11: Brush Bots
Lesson 12: Fridge Rover
Lesson 13: Sensory Robots
Lesson 14: Walking Solar Robot
Lesson 15: “Ship the Chip”
Lesson 16: Robotic Gripper
Lesson 17: Robot Factory
Lesson 18: Engineering Challenge – System Engineering a Robot
Lesson 19: Rover Races
Lesson 20: Do the Roomba: A Curriculum for Learning Roomba from iRobot.com
Lesson 21: Calculator Controlled Robots
Summary and Additional Resources

Learning approaches to applying robotics in science education. / Heilo Altin and Margus Pedaste. 2013 13 Pages

http://www.scientiasocialis.lt/jbse/files/pdf/vol12/365-377.Altin_JBSE_Vol.12.3.pdf

Abstract
The methodology and ideas behind educational robotics arise from the 1960s, when the first hardware platforms together with computers were used in research studies in schools. Since the 1990s, the market for educational robotics has grown, and there are many solutions available to use in schools. Despite a wide variety of platform approaches for using robots in education, they are still based on ideas that are decades old. This study evaluates different approaches used nowadays to teach with robots. Problembased, constructionist, and competitionbased learning are identified as the most common uses of robots under observation. Each approach is analysed qualitatively based on the published literature. Each has positive and negative properties; though none have been studied thoroughly using quantitative methods. Results indicate that all these approaches are used in schools with robots interdisciplinary. The current reasons for using robots are based mostly on teachers’ and students’ impressions. However, robotics can be seen as a “tool” to create many approaches to science education, such as inquiry learning and problem solving.

CURRICULUM AND INSTRUCTION
Curriculum and Instruction: Current Status of STEM Education
Curriculum and Instruction: The State’s Future Needs and Opportunities
Curriculum and Instruction: Key Recommendations
STUDENT ASSESSMENT
Student Assessment: Current Status of STEM Education
Student Assessment: The State’s Future Needs and Opportunities
Student Assessment: Key Recommendations
BUSINESS AND COMMUNITY PARTNERSHIPS
Business and Community Partnerships: Current Status of STEM Education
Business and Community Partnerships: The State’s Future Needs and Opportunities
Business and Community Partnerships: Key Recommendations
STEM EDUCATION IN CALIFORNIA: A CALL TO ACTION
AND NEXT STEPS
REFERENCES
ACKNOWLEDGEMENTS
APPENDICES
The STEM Task Force
STEM Task Force Recommendations
FOOTNOTES

Innovating Pedagogy 2019 : Exploring new forms of teaching, learning and assessment, to guide educators and policy makers. / The Open University. 2019 45 Pages

https://iet.open.ac.uk/file/innovating-pedagogy-2019.pdf

Partial Introduction : This is the seventh in a series of annual reports on innovations in teaching, learning, and assessment. The Innovating Pedagogy reports are intended for teachers, policy makers, academics, and anyone interested in how education may change over the next ten years.

Integrated STEM Education: A Systematic Review of Instructional Practices in Secondary Education. 1 May 2018 12 Pages

http://www.lectitopublishing.nl/viewpdf/integrated-stem-education-a-systematic-review-of-instructional-practices-in-secondary-education.pdf

Abstract
The shortage of graduates in Science, Technology, Engineering and Mathematics (STEM), has led to numerous attempts to increase students’ interest in STEM.

One emerging approach that has the potential to improve students' motivation for STEM is integrated STEM education. Nonetheless, the implementation of this new instructional strategy is not straightforward due to the lack of consensus about instructional practices in integrated STEM.

This paper contributes to this challenge by providing a well-defined framework for instructional practices in integrated STEM in secondary education, based on the results of a systematic review of existing Literature. The framework contains five key principles: integration of STEM content, problem-centered learning, inquiry-based learning, design-based learning and cooperative learning. The proposed framework has several benefits, including its applicability in the classroom and the possibility to describe integrated STEM on multiple dimensions. Nonetheless, further research is necessary to investigate the effects of integrated STEM on students' cognitive and affective learning outcomes.

Integrating Robotics Across the Primary School Curriculum. / Maeve Liston. [2019?] 4 Pages

https://conference.pixel-online.net/NPSE/files/npse/ed0007/FP/0171-NTST2813-FP-NPSE7.pdf

Abstract

Ireland's Digital Skills Strategy 2015-2020 aims to further embed technology and digital learning tools in primary and post-primary schools where all stakeholders work together to support the integration of ICT in every classroom in a systematic and focused way. This research paper reports on the design, development and implementation of a weeklong Robotics Summer Course for In-service Primary School Teachers.

The design of the course was a collaborative endeavour between academics in Initial Teacher Education in STEM, employees from the technology industry, primary school and post-primary teachers and the Professional Development Services for Teachers in Ireland. The course focused on the potential of integration ICT across the primary school curriculum by embedding a constructivist pedagogical orientation, showing teachers how to facilitate activities whereby learners can exercise creative, problem-solving, critical thinking, project work and team-working skills using robotics in the classroom. This paper will present findings from the teachers' evaluation of the course, reporting on their opinions on: their confidence, knowledge, ability and overall competencies in how to integrate robotics into their classroom; the design of future robotics summer courses and; the use of robotics in their future teaching. The findings can be used to inform future policy in STEM education and development of STEM courses for pre-service and in-service primary teachers and development of Corporate Social Responsibility (CSR) activities run by Technology Companies.

Introducing Robotics into the Nigerian Secondary Schools Curriculum : Likely Impacts, Challenges and Possible Solutions. / Samson Damilola, Abdulmuizz Ohiare and Habeeb Abiodun. 2016 5 Pages

http://oaji.net/articles/2016/786-1472659700.pdf

Abstract

One of the ways by which the youths of nowadays can be galvanized and empowered to go on and proffer solutions to the existing, emerging and future technology problems is by introducing them to robotics at their early age. The trend in most developed countries is that priority is usually placed on robotics at all levels of education i.e. primary, secondary and tertiary. This is expected considering the numerous areas of application of robots and its effects on economic growth and technological development of such countries. Reverse is the case in Nigeria. One would then wonder why robotics has not been fully and officially incorporated into the Nigeria secondary schools' curriculum. Probably, some of the top officials in government are not really convinced that introducing such would make any meaningful impact as far as the economy and technological advancement are concern. While relying on data obtained from various secondary sources, this study focuses on presenting the likely impacts and challenges of introducing robotics in to the Nigerian secondary school curriculum and to put possible solutions forward. The results showed that creation of job opportunity, increased interest in engineering and computer science among prospective university candidates, enhanced academic performance, and solution to the problem of —digital divide‖ are some of the likely impacts while Inadequate budgetary allocation, Inadequate physical infrastructure, and dwindling electrical power supply have been identified as the major challenges which are likely to be encountered if robotics is finally introduced into the Nigerian secondary schools curriculum.

Introduction to Robotics. / Hilda Pereyo and Susan Mallett. June 2011 98 Pages

http://www.k-12robotics.org/uploads/5/6/3/3/5633548/pdf_introduction_to_robotics.pdf

Contents