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Benakli, N.a , Kostadinov, B.a , Satyanarayana, A.b , Singh, S.a

Introducing computational thinking through hands-on projects using R with applications to calculus, probability and data analysis

(2017) International Journal of Mathematical Education in Science and Technology, 48 (3), pp. 393-427.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85000997337&doi=10.1080%2f0020739X.2016.1254296&partnerID=40&md5=f7e8ebc07b44e3e40f40aead1d47632d

DOI: 10.1080/0020739X.2016.1254296

AFFILIATIONS: Mathematics Department, NYC College of Technology, CUNY, Brooklyn, NY, United States;

Computer Systems Technology Department, NYC College of Technology, CUNY, Brooklyn, NY, United States

ABSTRACT: The goal of this paper is to promote computational thinking among mathematics, engineering, science and technology students, through hands-on computer experiments. These activities have the potential to empower students to learn, create and invent with technology, and they engage computational thinking through simulations, visualizations and data analysis. We present nine computer experiments and suggest a few more, with applications to calculus, probability and data analysis, which engage computational thinking through simulations, visualizations and data analysis. We are using the free (open-source) statistical programming language R. Our goal is to give a taste of what R offers rather than to present a comprehensive tutorial on the R language. In our experience, these kinds of interactive computer activities can be easily integrated into a smart classroom. Furthermore, these activities do tend to keep students motivated and actively engaged in the process of learning, problem solving and developing a better intuition for understanding complex mathematical concepts. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: computational probability with R; computational problem solving; data analysis with R; Monte Carlo games and simulations; scientific programming and simulations using R; Technology in mathematics education; visualization of Weierstrass functions

DOCUMENT TYPE: Article

SOURCE: Scopus

Huang, C.S.J.a , Su, A.Y.S.b , Yang, S.J.H.a c , Liou, H.-H.c

A collaborative digital pen learning approach to improving students' learning achievement and motivation in mathematics courses

(2017) Computers and Education, 107, pp. 31-44.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007618577&doi=10.1016%2fj.compedu.2016.12.014&partnerID=40&md5=35f373c063e624a83590632e54534bd8

DOI: 10.1016/j.compedu.2016.12.014

AFFILIATIONS: Research Center for Science and Technology for Learning, National Central University, Taiwan;

Advanced Communication Laboratory, National Central University, Taiwan;

Department of Computer Science and Information Engineering, National Central University, Taiwan

ABSTRACT: Mathematics education in contemporary elementary schools is mainly conducted in a conventional way by giving lectures. A teacher would pass on knowledge to students by giving lectures, and this type of one-way teaching method is prone to cause poor learning achievement. Many researchers have suggested the use of a collaborative problem solving to improve the situation. This research proposed the use of a digital pen learning system (DPLS) with collaborative problem solving to improve learning achievement and learning motivation in a conventional mathematics courses. A quasi-experimental design was adopted to set up all of the teaching activities, which involved 64 fourth-grade students for four weeks. The results of the research show that the learning achievement of the two experimental groups was significantly better than control group. There was no significant difference between the two experimental groups and control group in terms of learning motivation. There was no significant difference between the three groups in terms of learning attitude. © 2016 Elsevier Ltd

AUTHOR KEYWORDS: Applications in subject areas; Architectures for educational technology system; Interactive learning environments

DOCUMENT TYPE: Article

SOURCE: Scopus

Li, X., Huang, Z.J.

An inverted classroom approach to educate MATLAB in chemical process control

(2017) Education for Chemical Engineers, 19, pp. 1-12.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84992727026&doi=10.1016%2fj.ece.2016.08.001&partnerID=40&md5=0e993631f4e306f7b277214dfd16d887

DOI: 10.1016/j.ece.2016.08.001

AFFILIATIONS: Department of Chemical Engineering, Villanova University, Villanova, PA, United States

ABSTRACT: The inverted-classroom teaching format and the application of MATLAB/Simulink have recently generated considerable research interest in chemical engineering education. MATLAB/Simulink was introduced in mathematics-intensive courses due to its user-friendly interface for mathematical model simulations. Inverted classroom approach has been reported to be generally beneficial for engineering courses, but it has never been applied to MATLAB/Simulink education in a single course. The aim of our study is to examine the effectiveness of the inverted-classroom approach in developing MATLAB/Simulink skills of upper-division undergraduates in Villanova's chemical process control course. Teaching modules include solving ODE models, performing Laplace transform, and designing PID controllers. Surveys of students’ evaluation revealed that the three inverted-classroom teaching modules were effective in enhancing students’ understanding of mathematics-intensive process control concepts and improving their MATLAB simulation skills. Students’ overall feedback on the inverted-classroom format was positive as they gradually adapted to inverted-classroom learning format. © 2016 Institution of Chemical Engineers

AUTHOR KEYWORDS: Chemical process control; Inverted-classroom; Laplace transform; MATLAB; ODE simulation; Simulink

DOCUMENT TYPE: Article

SOURCE: Scopus

Kumar, V.a , Sharma, D.b

Cloud computing as a catalyst in STEM education

(2017) International Journal of Information and Communication Technology Education, 13 (2), pp. 38-51.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85012225908&doi=10.4018%2fIJICTE.2017040104&partnerID=40&md5=b0b584a66b41fc55c60753b4e06eabe5

DOI: 10.4018/IJICTE.2017040104

AFFILIATIONS: School of Business Studies, Sharda University, Greater Noida, India;

Jagannath University, Jaipur, India

ABSTRACT: The under representation of students in STEM disciplines creates big worries for the coming demands of STEM occupations. This requires new strategies to make curriculum interesting to enhance student's engagement in learning. Technology integration in curriculum makes more interesting and engaging, where students can learn with flexibility in time and place. This methodology creates and deepens interest in students towards learning with creativity and innovation. STEM students can work on authentic and real solutions within a technology-mediated learning environment, while inculcating higher order thinking skills. Technology-mediated environments support new ideas, real time collaboration and promotes peer learning. However, affordance as an adoption factor of technology in academics can be addressed by cloud computing technology. STEM education on cloud computing technology will gain access to its content rich features based on flexibility, accessibility, scalability, affordability, and reliability and enhanced agility. The cloud computing based STEM education infrastructure will inculcate development and experimentation skills in students. The present work (a) reviews scholarly work in cloud computing technology for simulations and prototypes for different STEM subjects, (b) outlines the benefits of using cloud computing technology for students pursuing STEM careers, and (c) presents the case studies of the successful implementation of cloud computing in STEM disciplines. © 2017, IGI Global.

AUTHOR KEYWORDS: Cloud Computing; Collaborative Computing; Elasticity; STEM Education; Virtual and Remote Laboratories

DOCUMENT TYPE: Review

SOURCE: Scopus

Smith, E.a , White, P.b

A ‘great way to get on’? The early career destinations of science, technology, engineering and mathematics graduates

(2017) Research Papers in Education, 32 (2), pp. 231-253.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84963877986&doi=10.1080%2f02671522.2016.1167236&partnerID=40&md5=1d741aa7dbaddf3815b3f15e7ff0096d

DOI: 10.1080/02671522.2016.1167236

AFFILIATIONS: School of Education, University of Leicester, Leicester, United Kingdom;

Department of Sociology, University of Leicester, Leicester, United Kingdom

ABSTRACT: Concerns about a shortage of highly skilled workers in the science, technology, engineering and mathematics (STEM) sector have been expressed frequently since the late 1940s. Although these claims have been challenged as being insufficiently grounded in evidence, they have formed the basis of policies directing considerable resources to STEM education, particularly in the university sector. This paper uses data from the Higher Education Statistical Agency from 1994 to 2010, covering more than three million UK graduates, to contribute to the existing research into the purported skills gap in the STEM sector. It examines their destinations six months after graduation to establish the proportion of graduates from different subject areas that enter graduate careers, with a particular focus on STEM graduates and highly skilled STEM occupations. The findings show that only a minority of graduates enter ‘graduate’ positions within six months of finishing their degree and many find themselves unemployed or underemployed. Overall, STEM graduates fare little better than non-STEM graduates and while graduates in some STEM subjects fare slightly better than average, those with other STEM degrees fare worse than those with non-STEM degrees. The findings appear incompatible with a true shortage of potential STEM workers and raise questions about employers’ expectations and the continued subsidisation of STEM degrees. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: graduate career destinations; Higher education; secondary data analysis; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Sharma, M.D.a , Rifkin, W.a , Tzioumis, V.a , Hill, M.a , Johnson, E.b , Varsavsky, C.c , Jones, S.d , Beames, S.e , Crampton, A.f , Zadnik, M.g , Pyke, S.h

Implementing and investigating distributed leadership in a national university network–SaMnet

(2017) Journal of Higher Education Policy and Management, 39 (2), pp. 169-182.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85012031650&doi=10.1080%2f1360080X.2017.1276660&partnerID=40&md5=fcd3a2631f1e72b6502c89c683f0bd62

DOI: 10.1080/1360080X.2017.1276660

AFFILIATIONS: School of Physics, The University of Sydney, Sydney, Australia;

Faculty of Science, Technology and Engineering, La Trobe University, Bundoora, Australia;

Faculty of Science, Monash University, Clayton, Australia;

School of Zoology, University of Tasmania, Hobart, Australia;

Faculty of Science, University of Technology Sydney, Sydney, Australia;

Faculty of Science, Charles Sturt University, Wagga Wagga, Australia;

Department of Applied Physics, Curtin University, Perth, Australia;

Department of Chemistry, The University of Adelaide, Adelaide, Australia

ABSTRACT: The literature suggests that collaborative approaches to leadership, such as distributed leadership, are essential for supporting educational innovators in leading change in teaching in universities. This paper briefly describes the array of activities, processes and resources to support distributed leadership in the implementation of a network, the Science and Mathematics Network of Australian University Educators–SaMnet. The research study investigated participating educational innovators’ experiences of distributed leadership using a mixed method approach after 2 years of immersion in SaMnet. Fifty innovators from 100 were surveyed and data analysed to obtain influences of the teams, the institution and SaMnet. Focus groups were used to extract rich descriptions of the experiences of the innovators. The study suggests that distributed leadership as the approach underpinning SaMnet cultivated leadership helping to complement team and institutional influences in a measurable way and to support educational innovators in leading change in university science and mathematics teaching. © 2017 Association for Tertiary Education Management and the LH Martin Institute for Tertiary Education Leadership and Management.

AUTHOR KEYWORDS: Collaborative approaches to leadership; communities of practice; distributed leadership; networks for building capacity; science and mathematics education

DOCUMENT TYPE: Article

SOURCE: Scopus

Brunner, E.

Mathematics Teaching in Multi-Grade Classes of Primary School: A Description Related to Various Design Elements and the Teachers’ Convictions [Mathematikunterricht in Mehrjahrgangsklassen der Primarschule: Eine Deskription entlang verschiedener Gestaltungselemente und Einschätzungen der Lehrpersonen]

(2017) Journal fur Mathematik-Didaktik, 38 (1), pp. 57-91.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013236889&doi=10.1007%2fs13138-016-0109-1&partnerID=40&md5=6afd30806b46e813cf23b62c5e365a3d

DOI: 10.1007/s13138-016-0109-1

AFFILIATIONS: Pädagogische Hochschule Thurgau, Unterer Schulweg 3, Kreuzlingen, Switzerland

ABSTRACT: The research to be presented in this article shows for a sample of 99 teachers who are in charge of multi-grade or mixed-age classrooms, how they describe their mathematics lessons under these specific structural conditions with respect to various elements of instructional design. The study asks about the frequency of using these elements of instructional design and certain organizational forms of mixed-age learning related to the area of mathematical content and the different phases of the learning process. Furthermore it addresses the teachers’ convictions about mixed-age learning in mathematics education and examine to what extent they can be related to the current research findings. The study inquires into the actual implementation of mixed-age learning in mathematics education and thus contributes to a topical issue in school development and asks from a content-specific perspective about the design of mathematics education in these multi-grade or multi-age classes. The results suggest that mathematics in multi-grade classrooms is mostly taught in a regular single-grade setting all the same. This does not match up to the expectations and intentions of current school development efforts. Moreover, the teachers consider the structural conditions in multi-grade mathematics classrooms to be very demanding. © 2016, GDM.

AUTHOR KEYWORDS: Educational research; Multi-age classes; Primary school; School development; Teachers

DOCUMENT TYPE: Article

SOURCE: Scopus

Lin, K.-Y.a , Williams, P.J.b

Two-stage hands-on technology activity to develop preservice teachers’ competency in applying science and mathematics concepts

(2017) International Journal of Technology and Design Education, 27 (1), pp. 89-105.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84946112514&doi=10.1007%2fs10798-015-9340-1&partnerID=40&md5=1e8f4fcb5dbb0b7f7c12e2f04a105150

DOI: 10.1007/s10798-015-9340-1

AFFILIATIONS: Department of Technology Application and Human Resource Development, National Taiwan Normal University, No. 162, Heping East Road Section 1, Taipei, Taiwan;

The Technology, Environmental, Mathematics and Science Education Research Centre, University of Waikato, Private Bag 3105, Hamilton, New Zealand

ABSTRACT: This paper discusses the implementation of a two-stage hands-on technology learning activity, based on Dewey’s learning experience theory that is designed to enhance preservice teachers’ primary and secondary experiences in developing their competency to solve hands-on problems that apply science and mathematics concepts. The major conclusions were that: (1) preservice teachers understood the science and mathematics concepts related to the hands-on activity, but they need more help in exploring practical products of applying discipline related concepts for the purpose of stimulating their design ideas; and (2) the two-stage hands-on technology learning activity served as useful prompts in developing preservice teachers’ primary and secondary experiences in applying science and mathematics concepts during the design process. However, it was evident that preservice teachers still needed more training in improving their design ideas by the application of more in-depth related science and mathematics concepts. © 2015, Springer Science+Business Media Dordrecht.

AUTHOR KEYWORDS: Mathematics; Preservice teacher; Science; Technology; Two-stage hands-on learning activity

DOCUMENT TYPE: Article

SOURCE: Scopus

McGarr, O., Lynch, R.

Monopolising the STEM agenda in second-level schools: exploring power relations and subject subcultures

(2017) International Journal of Technology and Design Education, 27 (1), pp. 51-62.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84944699021&doi=10.1007%2fs10798-015-9333-0&partnerID=40&md5=ccc9a362b580d01ff647ac75cc3b453f

DOI: 10.1007/s10798-015-9333-0

AFFILIATIONS: Department of Education and Professional Studies, University of Limerick, Limerick, Ireland

ABSTRACT: The ubiquitous and often pervasive expansion of the science, technology, engineering and mathematics (STEM) agenda across global education systems has largely gone uncontested. Strategic efforts to build on perceived natural subject synergies across the separate STEM disciplines are promoted as central to supporting the growth of economies through the development of human capital and by ensuring the supply of suitably trained individuals for vocational roles in these areas. However, these efforts are predicated on the assumption that such perceived natural subject synergies can easily support pedagogical complimentary and in so doing, often fail to acknowledge the social histories of the subjects involved. In this paper the authors examine the divergence in treatment of STEM subjects within the Irish second-level context through the lenses of subject hierarchies and social class. The cultural capital associated with studying each of the respective STEM subjects in school is considered and the objectives of the STEM agenda are problematised. © 2015, Springer Science+Business Media Dordrecht.

AUTHOR KEYWORDS: Cultural capital; STEM education; Subject subcultures; Technology education

DOCUMENT TYPE: Article

SOURCE: Scopus

Al Salami, M.K.a , Makela, C.J.a , de Miranda, M.A.a b

Assessing changes in teachers’ attitudes toward interdisciplinary STEM teaching

(2017) International Journal of Technology and Design Education, 27 (1), pp. 63-88.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84946120615&doi=10.1007%2fs10798-015-9341-0&partnerID=40&md5=e967e105414c8fbae5b949457e61baf6

DOI: 10.1007/s10798-015-9341-0

AFFILIATIONS: School of Education, Colorado State University, Fort Collins, CO, United States;

Department of Electrical and Computer Engineering, Colorado State University, Fort Collins, CO, United States

ABSTRACT: Integrating engineering and technology concepts into K-12 science and math curricula through engineering design project-based learning has been found to increase students’ interest in science, technology, engineering, and mathematics (STEM), however preparing teachers to shift to interdisciplinary teaching remains a significant challenge. Primarily teachers need to develop both skills and attitudes toward interdisciplinary teaching. In doing so, professional development (PD) is considered a key component in helping teachers through this transformation process. In an educational environment of accountability, measuring the effects of PD programs on teacher behaviors and capacity is essential but often elusive. The current study describes the change in attitudes to interdisciplinary teaching of 29 self-selected middle and high school teachers who participated a PD workshop and in delivering a 12–15 week interdisciplinary teaching and design problem unit that spanned multiple STEM subjects. This quasi-experimental pilot study implemented a single group pretest–posttest design using survey methods to collect data from the participants at two intervals; at the time of the PD workshop and at the completion of the teaching unit that emphasized a long-term engineering design problem. The goals of this research are to (1) assess the changes in attitudes to interdisciplinary teaching, attitudes to teamwork, teaching satisfaction, and resistance to change, (2) explore relationships among these changes, (3) and describe the variation in these changes across teachers’ gender, school level, discipline taught, and education level. © 2015, Springer Science+Business Media Dordrecht.

AUTHOR KEYWORDS: Engineering design; Interdisciplinary STEM teaching; K-12 STEM education; Teacher attitudes; Teacher professional development

DOCUMENT TYPE: Article

SOURCE: Scopus

Simon, R.M., Wagner, A., Killion, B.

Gender and choosing a STEM major in college: Femininity, masculinity, chilly climate, and occupational values

(2017) Journal of Research in Science Teaching, 54 (3), pp. 299-323.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995579352&doi=10.1002%2ftea.21345&partnerID=40&md5=d6f93a753fd400d1e64735c18c14e9ea

DOI: 10.1002/tea.21345

AFFILIATIONS: Department of Sociology, The University of Alabama in Huntsville, Huntsville, AL, United States

ABSTRACT: Masculinity and femininity have played a substantial role in how social scientists explain the gender gap in science, technology, engineering, and mathematics (STEM) careers. The masculine culture of science is thought to be inconsistent with occupational values associated with feminine personalities, and to create a discriminatory academic environment for those who cannot adapt to it. However, there has been little systematic investigation into the extent to which masculine and feminine personality characteristics are actually correlated with STEM career outcomes, or how the effects of masculine and feminine personality characteristics on STEM career outcomes may be different when embodied in women compared to men. This study tests several hypotheses concerning the relationship of masculine and feminine personality characteristics to occupational values, perceptions of academic climate, and selection of a STEM major in college among a sample of 752 students enrolled at a major public university. We find little support for the hypothesis that masculine personality characteristics are especially rewarded in STEM majors. However, we also find that women pay a femininity penalty in STEM majors, while more abundant feminine personality traits in men render them more likely to major in a STEM field, after accounting for occupational values. © 2016 Wiley Periodicals, Inc. J Res Sci Teach 54: 299–323, 2017. © 2016 Wiley Periodicals, Inc.

AUTHOR KEYWORDS: chilly climate; femininity; gender; masculinity; occupational values; postsecondary education; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Thomas, V.G.a , Parsons, B.A.b

Culturally Responsive Evaluation Meets Systems-Oriented Evaluation

(2017) American Journal of Evaluation, 38 (1), pp. 7-28.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013174657&doi=10.1177%2f1098214016644069&partnerID=40&md5=1a0f2238dce98c673da91712b8cadc7d

DOI: 10.1177/1098214016644069

AFFILIATIONS: Department of Human Development and Psychoeducational Studies, School of Education, Howard University, Washington, DC, United States;

InSites, Fort Collins, CO, United States

ABSTRACT: The authors of this article each bring a different theoretical background to their evaluation practice. The first author has a background of attention to culturally responsive evaluation (CRE), while the second author has a background of attention to systems theories and their application to evaluation. Both have had their own evolution of thinking and application of their respective conceptual traditions over the last 20+ years, influenced considerably by their involvement in the American Evaluation Association. They recently worked together to build evaluation capacity among evaluators of science, technology, engineering, and mathematics (STEM) education programs, in which they explored how these two conceptual and theoretical paths connect. In this article, the authors present their current thinking about the relationship between CRE and systems-oriented evaluation. In a case example, they illustrate the value of integrating the two perspectives to determine the guiding questions for an evaluation of a STEM education project. © 2016, © The Author(s) 2016.

AUTHOR KEYWORDS: culturally responsive evaluation; STEM education evaluation; systems change; systems-oriented evaluation

DOCUMENT TYPE: Article

SOURCE: Scopus

Hoeg, D.G., Bencze, J.L.

Values Underpinning STEM Education in the USA: An Analysis of the Next Generation Science Standards

(2017) Science Education, 101 (2), pp. 278-301. Cited 1 time.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013076648&doi=10.1002%2fsce.21260&partnerID=40&md5=50c326e0af899d608c575c3b2b2cd3c2

DOI: 10.1002/sce.21260

AFFILIATIONS: Curriculum, Teaching and Learning, Ontario Institute for Studies in Education, University of Toronto, Toronto, ON, Canada

ABSTRACT: The Next Generation Science Standards (NGSS) were designed to address poor science and math performance in United States schools by inculcating globally competitive science, technology, engineering, and mathematics literacies relevant to participation in future society. Considering the complex network of influences involved in the development of the NGSS, the purpose of this paper is to evaluate how educational values are embedded in the discourse of the standards. Using critical discourse analysis and content analysis, we evaluated how themes related to (i) performance, (ii) accessibility, and (iii) innovation and creativity are discursively constituted in the NGSS. Our analysis indicates the NGSS prioritizes: measurable and reproducible performances; the standards appear to be based on a conception of accessibility closely aligned with equality, and self-investment, and; innovation and creativity are discursively constituted as attributes that can be developed through specific, prescribed practices. We discuss these findings in relation to the goals of the NGSS and potential teaching and learning outcomes resulting from education based on the standards. © 2017 Wiley Periodicals, Inc.

DOCUMENT TYPE: Article

SOURCE: Scopus

Gomez, C.J.a , Yoshikawa, H.b

Earthquake effects: Estimating the relationship between exposure to the 2010 Chilean earthquake and preschool children's early cognitive and executive function skills

(2017) Early Childhood Research Quarterly, 38, pp. 127-136.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994050078&doi=10.1016%2fj.ecresq.2016.08.004&partnerID=40&md5=0a91fd3bd1065249c7e61a78ed327908

DOI: 10.1016/j.ecresq.2016.08.004

AFFILIATIONS: The RAND Corporation, United States;

New York University, New York, NY, United States

ABSTRACT: Little is known about how the experience of an earthquake affects young children's cognitive outcomes. On February 27, 2010, a severe earthquake shook southern Chile. The earthquake occurred during the course of a large-scale evaluation of an early childhood education intervention (child average age = 53 months) in Santiago, such that one cohort of children (n = 698) experienced baseline data collection 3–12 weeks after the earthquake occurred, while a different cohort of children (n = 720) did not. In this paper, we used these available evaluation data to conduct two sets of analyses that explore the relationship between preschool children's exposure to the 2010 Chilean earthquake and their early language, pre-literacy, mathematics and executive function outcomes. In the first set of analyses, we employed a propensity score analysis to estimate the short-term effect of the earthquake on preschool- aged children's early learning and executive function outcomes. Results suggest that children who experienced the earthquake had lower scores on some early language and pre-literacy assessments than those who did not, with effect sizes of approximately 20% of a standard deviation. Results from the second set of analyses suggest that among the families who experienced the earthquake, children whose parents reported more earthquake- related stressors performed significantly lower on some early language and pre-literacy outcomes. Implications of these findings for disaster relief efforts and future research are discussed. © 2016 Elsevier Inc.

AUTHOR KEYWORDS: Disasters; Early childhood development; Earthquakes; Propensity scores

DOCUMENT TYPE: Article

SOURCE: Scopus

Braun, D.C.a , Gormally, C.a , Clark, M.D.b

The deaf mentoring survey: A community cultural wealth framework for measuring mentoring effectiveness with underrepresented students

(2017) CBE Life Sciences Education, 16 (1), art. no. ar10, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85012911607&doi=10.1187%2fcbe.15-07-0155&partnerID=40&md5=ea1be3dc89a70d0888b4f0e61ceb666b

DOI: 10.1187/cbe.15-07-0155

AFFILIATIONS: Department of Science, Technology, and Mathematics, Gallaudet University, Washington, DC, United States;

Lamar University, Beaumont, TX, United States

ABSTRACT: Disabled individuals, women, and individuals from cultural/ethnic minorities continue to be underrepresented in science, technology, engineering, and mathematics (STEM). Research has shown that mentoring improves retention for underrepresented individuals. However, existing mentoring surveys were developed to assess the majority population, not underrepresented individuals. We describe the development of a next-generation mentoring survey built upon capital theory and critical race theory. It emphasizes community cultural wealth, thought to be instrumental to the success of individuals from minority communities. Our survey targets relationships between deaf mentees and their research mentors and includes Deaf community cultural wealth. From our results, we identified four segregating factors: Being a Scientist, which incorporated the traditional capitals; Deaf Community Capital; Asking for Accommodations; and Communication Access. Being a Scientist scores did not vary among the mentor and mentee variables that we tested. However, Deaf Community Capital, Asking for Accommodations, and Communication Access were highest when a deaf mentee was paired with a mentor who was either deaf or familiar with the Deaf community, indicating that cultural competency training should improve these aspects of mentoring for deaf mentees. This theoretical framework and survey will be useful for assessing mentoring relationships with deaf students and could be adapted for other underrepresented groups. © 2017 D. C. Braun et al. CBE-Life Sciences Education and 2017 The American Society for Cell Biology.

DOCUMENT TYPE: Article

SOURCE: Scopus

Hains-Wesson, R.a , Young, K.b

A collaborative autoethnography study to inform the teaching of reflective practice in STEM

(2017) Higher Education Research and Development, 36 (2), pp. 297-310.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84976334783&doi=10.1080%2f07294360.2016.1196653&partnerID=40&md5=e5300f55eee7e41b8c058a8c13846380

DOI: 10.1080/07294360.2016.1196653

AFFILIATIONS: Student Advancement, Swinburne University of Technology, Victoria, Australia;

Faculty of Science, Engineering and Built Environment, Deakin University, Victoria, Australia

ABSTRACT: The paper explores a collaborative self-study, autoethnography research project, which aided in informing practice for the teaching of reflective practice in Science, Technology, Engineering and Mathematics (STEM) at an Australian university. Self-report methods were used, because it enabled the collection of a variety of self-awareness data generated processes to help produce insights and understandings. This was achieved by undertaking a systematic approach to the exploration of a critical friendship between two academic support staff members alongside reflections from a recorded, focus group interview with nine STEM teachers. Four self-awareness data generated processes were used: (1) self-reflections; (2) collaborative reflections; (3) reflections on pertinent literature findings and (4) reflections from nine STEM teachers. A thematic analysis of the data was undertaken, which resulted in the discovery of three turning points such as moments of understandings that challenge assumptions and/or lead to new insights. The findings indicated that a STEM-centric, scaffolded approach that utilised the scientific method for reflective practice enabled the development of a shared understanding around teaching and assessing reflective practice for STEM teachers. First, because it boosted self-confidence and second, because it reduced scepticism around reflective practice as a non-scientific form of learning. © 2016 HERDSA.

AUTHOR KEYWORDS: Artefact; autoethnography; Engineering and Mathematics (STEM) education; reflective practice; Science; self-report study; Technology

DOCUMENT TYPE: Article

SOURCE: Scopus

Lake, W.a , Wallin, M.c , Woolcott, G.b , Boyd, W.b , Foster, A.b , Markopoulos, C.b , Boyd, W.a

Applying an alternative mathematics pedagogy for students with weak mathematics: meta-analysis of alternative pedagogies

(2017) International Journal of Mathematical Education in Science and Technology, 48 (2), pp. 215-228.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84992317440&doi=10.1080%2f0020739X.2016.1245876&partnerID=40&md5=802d92c28b8f5bb81de5ce4bffd89a81

DOI: 10.1080/0020739X.2016.1245876

AFFILIATIONS: School of Environment, Science & Engineering, Southern Cross University, Lismore, Australia;

School of Education, Southern Cross University, Lismore, Australia;

Library, Southern Cross University, Lismore, Australia

ABSTRACT: Student mathematics performance and the need for work-ready graduates to be mathematics-competent is a core issue for many universities. While both student and teacher are responsible for learning outcomes, there is a need to explicitly acknowledge the weak mathematics foundation of many university students. A systematic literature review was undertaken of identified innovations and/or interventions that may lead to improvement in student outcomes for university mathematics-based units of study. The review revealed the importance of understanding the foundations of student performance in higher education mathematics learning, especially in first year. Pre-university mathematics skills were identified as significant in student retention and mathematics success at university, and a specific focus on student pre-university mathematics skill level was found to be more effective in providing help, rather than simply focusing on a particular at-risk group. Diagnostics tools were found to be important in identifying (1) student background and (2) appropriate intervention. The studies highlighted the importance of appropriate and validated interventions in mathematics teaching and learning, and the need to improve the learning model for mathematics-based subjects, communication and technology innovations. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: diagnostics; interventions; Mathematics pedagogy; meta-analysis; pre-university mathematics

DOCUMENT TYPE: Article

SOURCE: Scopus

Sparavigna, A.C.a , Baldi, M.M.b

Symmetry and the golden ratio in the analysis of a regular pentagon

(2017) International Journal of Mathematical Education in Science and Technology, 48 (2), pp. 306-316.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84988667363&doi=10.1080%2f0020739X.2016.1233587&partnerID=40&md5=81f4de8f63928e3181ba1a2b042cca09

DOI: 10.1080/0020739X.2016.1233587

AFFILIATIONS: Department of Applied Science and Technology, Politecnico di Torino, Torino, Italy;

Department of Control and Computer Engineering, Politecnico di Torino, Torino, Italy

ABSTRACT: The regular pentagon had a symbolic meaning in the Pythagorean and Platonic philosophies and a subsequent important role in Western thought, appearing also in arts and architecture. A property of regular pentagons, which was probably discovered by the Pythagoreans, is that the ratio between the diagonal and the side of these pentagons is equal to the golden ratio. Here, we will study some relations existing between a regular pentagon and this ratio. First, we will focus on the group of fivefold rotational symmetry, to find the position in the complex plane of the vertices of this geometric figure. Then, we will propose an analytic method to solve the same problem based on the Cartesian coordinates, a method where we find the golden ratio without any specific geometric consideration. This study shows a comparison of the use of complex numbers, symmetries and analytic methods, applied to a subject which can be interesting for general education in mathematics. In fact, the proposed approach can convey and link several concepts, requiring only a general pre-college education, showing at the same time the richness that mathematics can offer in solving geometric problems. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: Geometry; golden ratio; mathematics; mathematics education; symmetry

DOCUMENT TYPE: Note

SOURCE: Scopus

Cavlazoglu, B.a , Stuessy, C.b

Changes in science teachers' conceptions and connections of STEM concepts and earthquake engineering

(2017) Journal of Educational Research, pp. 1-16. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013073349&doi=10.1080%2f00220671.2016.1273176&partnerID=40&md5=4e7c49f8fab886d177dd5defc84b586e

DOI: 10.1080/00220671.2016.1273176

AFFILIATIONS: Department of Mathematics and Science Education, Fatih Faculty of Education, Karadeniz Technical University, Trabzon, Turkey;

Department of Teaching, Learning and Culture, Texas A&M University, College Station, Texas, USA

ABSTRACT: The authors find justification for integrating science, technology, engineering, and mathematics (STEM) in the complex problems that today's students will face as tomorrow's STEM professionals. Teachers with individual subject-area specialties in the STEM content areas have limited experience in integrating STEM. In this study, the authors investigated the conceptual changes of secondary school teachers teaching domain-specific STEM courses after a week-long professional development experience integrating earthquake engineering and domain-specific concepts. They documented and then triangulated outcomes of the experience using participating teachers' concept maps and teacher-generated written materials, respectively. Statistical comparisons of participants' concept maps revealed significant increases in their overall understanding of earthquake engineering and more accurate linkages with and among science domain-specific concepts. Content analyses of teachers' learning products confirmed the concept map analysis and also provided evidence of transfer of workshop learning experiences into teacher-designed curriculum products accurately linking earthquake engineering and domain-specific STEM content knowledge. © 2017 Taylor & Francis Group, LLC

AUTHOR KEYWORDS: Authentic assessment; concept maps; earthquake engineering; engineering-oriented teacher professional development; integrated STEM; science and engineering integration; STEM education

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Chalmers, C., Carter, M.L., Cooper, T., Nason, R.

Implementing “Big Ideas” to Advance the Teaching and Learning of Science, Technology, Engineering, and Mathematics (STEM)

(2017) International Journal of Science and Mathematics Education, pp. 1-19. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85012237844&doi=10.1007%2fs10763-017-9799-1&partnerID=40&md5=f4639023f48d2b9e906b377777cd7721

DOI: 10.1007/s10763-017-9799-1

AFFILIATIONS: Queensland University of Technology, S Block, Victoria Park Road, Kelvin Grove, QLD, Australia

ABSTRACT: Although education experts are increasingly advocating the incorporation of integrated Science, Technology, Engineering, and Mathematics (STEM) curriculum units to address limitations in much current STEM teaching and learning, a review of the literature reveals that more often than not such curriculum units are not mediating the construction of in-depth STEM knowledge. In this paper, we conjecture that the challenge of generating integrated STEM curriculum units that overcome this limitation and facilitate in-depth learning of and about STEM can be met by the use of three types of big ideas: within-discipline big ideas that have application in other STEM disciplines, cross-discipline big ideas, and encompassing big ideas. We provide a six-component framework (together with an example of the framework in action) that can be used to scaffold pre- and in-service teachers’ development of integrated STEM curriculum units based around these types of big ideas. The paper concludes by discussing possible directions for future research and development in this field. © 2017 Ministry of Science and Technology, Taiwan

AUTHOR KEYWORDS: Big ideas; Integration; STEM; Themes

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Gaquere-Parker, A.C.a , Hill, P.S.b , Haaf, M.P.c , Parker, C.D.d , Doles, N.A.a , Yi, A.K.a , Kaminski, T.A.a

Pigment Synthesis for the Exploration of Binding Media Using a Lead-Free Alternative to Chrome Yellow

(2017) Journal of Chemical Education, 94 (2), pp. 235-239.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85012937394&doi=10.1021%2facs.jchemed.6b00479&partnerID=40&md5=7972727d3b93abce3bd067619556a45c

DOI: 10.1021/acs.jchemed.6b00479

AFFILIATIONS: Department of Chemistry, University of West Georgia, Carrollton, Georgia, United States;

Department of Chemistry, Millersville University, Millersville, Pennsylvania, United States;

Department of Chemistry, Ithaca College, Ithaca, New York, United States;

Department of Chemistry, Clark Atlanta University, Atlanta, Georgia, United States

ABSTRACT: Generating enthusiasm among nonscience majors in a laboratory course is a difficult task. Often, students are asked to perform a precipitation reaction, only to collect and then safely dispose of the solid without detailing composition, properties, or uses. In an effort to keep the students engaged, this laboratory exercise presents an innovative way to use the product of a precipitation reaction. The reaction chosen produces basic zinc(II) chromate, a yellow pigment that can be combined with various paint binders such as beeswax, gum Arabic, egg yolk, linseed oil, and acrylic medium. The students then test their paints on a canvas and analyze their different physical properties. This exercise can be tailored to match different undergraduate levels, ranging from nonscience majors to chemistry majors and be used as a part of a STEAM (science, technology, engineering, arts, and mathematics) activity. A brief discussion on historical paint binders and their chemistry is also included. © 2016 The American Chemical Society and Division of Chemical Education, Inc.

AUTHOR KEYWORDS: Applications of Chemistry; Dyes/Pigments; First Year Undergraduate/General; Hands-On Learning/Manipulatives; Laboratory Instruction; Precipitation/Solubility

DOCUMENT TYPE: Article

SOURCE: Scopus

Ní Fhloinn, E.a , Carr, M.b

Formative assessment in mathematics for engineering students

(2017) European Journal of Engineering Education, pp. 1-13. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85012066446&doi=10.1080%2f03043797.2017.1289500&partnerID=40&md5=74557536c98c4ab29a63739ccc2bb5a2

DOI: 10.1080/03043797.2017.1289500

AFFILIATIONS: School of Mathematical Sciences, Dublin City University, Dublin, Ireland;

School of Multidisciplinary Technologies, Dublin Institute of Technology, Dublin, Ireland

ABSTRACT: In this paper, we present a range of formative assessment types for engineering mathematics, including in-class exercises, homework, mock examination questions, table quizzes, presentations, critical analyses of statistical papers, peer-to-peer teaching, online assessments and electronic voting systems. We provide practical tips for the implementation of such assessments, with a particular focus on time or resource constraints and large class sizes, as well as effective methods of feedback. In addition, we consider the benefits of such formative assessments for students and staff. © 2017 SEFI

AUTHOR KEYWORDS: assessment for learning; engineering mathematics; Formative assessments; low-stakes assessment; mathematics education

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Schroeder, N.L.a , Traxler, A.L.b

Humanizing Instructional Videos in Physics: When Less Is More

(2017) Journal of Science Education and Technology, pp. 1-10. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85011596085&doi=10.1007%2fs10956-016-9677-6&partnerID=40&md5=784ab9fe84b12c24a544dd15e2669ea8

DOI: 10.1007/s10956-016-9677-6

AFFILIATIONS: Department of Leadership Studies in Education and Organizations, Wright State University, 3640 Colonel Glenn Highway, Dayton, OH, United States;

Department of Physics, Wright State University, 3640 Colonel Glenn Highway, Dayton, OH, United States

ABSTRACT: Many instructors in science, technology, engineering, and mathematics fields are striving to create active learning environments in their classrooms and in doing so are frequently moving the lecture portion of their course into online video format. In this classroom-based study, we used a two group randomized experimental design to examine the efficacy of an instructional video that incorporates a human hand demonstrating and modeling how to solve frictional inclined plane problems compared to an identical video that did not include the human hand. The results show that the learners who viewed the video without the human hand present performed significantly better on a learning test and experienced a significantly better training efficiency than the learners who viewed the video with the human hand present. Meanwhile, those who learned with the human hand present in the instructional video rated the instructor as being more humanlike and engaging. The results have implications for both theory and practice. Implications for those designing instructional videos are discussed, as well as the limitations of the current study. © 2017 Springer Science+Business Media New York

AUTHOR KEYWORDS: Force; Friction; Instructional video; Learner control; Pedagogical agent; Physics education

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Boyd, M., Tian, S.

STEM Education and STEM Work: Nativity Inequalities in Occupations and Earnings

(2017) International Migration, 55 (1), pp. 75-98.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007529855&doi=10.1111%2fimig.12302&partnerID=40&md5=db56fc48ec9525e575c5d744fcc58bb3

DOI: 10.1111/imig.12302

AFFILIATIONS: University of Toronto, Canada

ABSTRACT: The recruitment of skilled workers with expertise in science, technology, engineering and mathematics (STEM) is a core component of North American immigration policies. However, few studies examine the labour market integration of immigrant STEM educated workers. Multivariate analysis of the 2011 National Household Survey show that STEM educated immigrants who arrive as adults are less likely than the Canadian born to have STEM jobs and they earn less than their Canadian born counterparts. These patterns partly reflect their socio-demographic characteristics, particularly their lower language proficiencies (measured as a combination of mother tongue and languages spoken at home) and the receipt of their degrees in institutions outside of Canada. These immigrant workers arrived primarily in the skilled worker programme that did not require pre-arranged employment. Policy changes in recruitment and their implications for future STEM immigrant workers are discussed in the conclusion. © 2016 The Authors. International Migration © 2016 IOM

DOCUMENT TYPE: Article

SOURCE: Scopus

Giménez, V.a , Thieme, C.b , Prior, D.a , Tortosa-Ausina, E.c

An international comparison of educational systems: a temporal analysis in presence of bad outputs

(2017) Journal of Productivity Analysis, 47 (1), pp. 83-101.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010765004&doi=10.1007%2fs11123-017-0491-9&partnerID=40&md5=55f14ff9e4f2b0ee2df834ba9ab80893

DOI: 10.1007/s11123-017-0491-9

AFFILIATIONS: Universitat Autònoma de Barcelona, Bellaterra (Barcelona), Spain;

Universidad Diego Portales, Avenida Santa Clara 797, Huechuraba, Santiago, Chile;

Universitat Jaume I, Avenida de Vicent Sos Baynat, s/n, Castellón, Castelló, Spain

ABSTRACT: This study uses the global non-radial Malmquist index to measure performance change in the educational systems of 29 countries/economies participating in PISA 2003 and 2012 for students at age 15 in the disciplines of mathematics and reading. This methodology is particularly appropriate both for its desirable properties as well as its suitability for the educational context. Results indicate a positive evolution in educational systems’ performance during this period. This improvement is mainly due a positive efficiency change, which offsets the negative technological change observed. Nevertheless, a deeper scrutiny at the country level shows that results varied remarkably among them. © 2017, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Education; Efficiency; Global non-radial Malmquist index; PISA

DOCUMENT TYPE: Article

SOURCE: Scopus

Carpi, A.a , Ronan, D.M.b , Falconer, H.M.c , Lents, N.H.a

Cultivating minority scientists: Undergraduate research increases self-efficacy and career ambitions for underrepresented students in STEM

(2017) Journal of Research in Science Teaching, 54 (2), pp. 169-194.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84982843801&doi=10.1002%2ftea.21341&partnerID=40&md5=bf6e68bf096b6d8dea5bfc323531e86f

DOI: 10.1002/tea.21341

AFFILIATIONS: Department of Sciences, John Jay College of Criminal Justice, City University of New York, 524 West 59th Street, New York, NY, United States;

Research Foundation of the City University of New York, New York, NY, United States;

Department of English, Northeastern University, Boston, MA, United States

ABSTRACT: In this study, Social Cognitive Career Theory (SCCT) is used to explore changes in the career intentions of students in an undergraduate research experience (URE) program at a large public minority-serving college. Our URE model addresses the challenges of establishing an undergraduate research program within an urban, commuter, underfunded, Minority-Serving Institution (MSI). However, our model reaches beyond a focus on retention and remediation toward scholarly contributions and shifted career aspirations. From a student's first days at the College to beyond their graduation, we have encouraged them to explore their own potential as scientists in a coordinated, sequential, and self-reflective process. As a result, while the program's graduates have traditionally pursued entry-level STEM jobs, graduates participating in mentored research are increasingly focused on professional and academic STEM career tracks involving post-graduate study. In addition to providing an increasingly expected experience and building students’ skills, participation in undergraduate research is seen to have a transformative effect on career ambitions for many students at MSIs. While undergraduate research is often thought of in context of majority-serving institutions, we propose that it serves as a powerful equalizer at MSIs. Building on the institutional characteristics that drive diversity, our students produce scholarly work and pursue graduate degrees, in order to address the long-standing under-representation of minorities in the sciences. © 2016 Wiley Periodicals, Inc. J Res Sci Teach 54: 169–194, 2017. © 2016 Wiley Periodicals, Inc.

AUTHOR KEYWORDS: science; self-efficacy; title V; undergraduate research; urban education

DOCUMENT TYPE: Article

SOURCE: Scopus

Bell, D.a , Wooff, D.a , McLain, M.b , Morrison-Love, D.c

Analysing design and technology as an educational construct: an investigation into its curriculum position and pedagogical identity

(2017) Curriculum Journal, pp. 1-20. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85012277235&doi=10.1080%2f09585176.2017.1286995&partnerID=40&md5=c5f10c8800bc2b710b43dc9b2f9c7e37

DOI: 10.1080/09585176.2017.1286995

AFFILIATIONS: Faculty of Education, Edge Hill University, Ormskirk, United Kingdom;

School of Education, Liverpool John Moores University, IM Marsh Campus, Liverpool, United Kingdom;

School of Education, University of Glasgow, Glasgow, United Kingdom

ABSTRACT: The hierarchal status of academic disciplines, what defines valuable or legitimate knowledge and what should we teach our children is a topic of much debate. Amidst concerns of an academic decline, tackling the culture of low expectation and anti-intellectualism, the need to address social justice, and its by-product of cultural reproduction, is the focus of current education policy. Set within the UK, this paper presents a critical review of the literature relating to disciplinary knowledge and teaching and learning regimes, specifically seeking to explore the subcultures which exist between design and technology and its associated curricula counterparts that combine to produce science, technology, engineering and mathematics (STEM). The purpose being to proffer an explanation that is supportive in developing an understanding as to why design and technology is perceived by many to be of less value than its STEM counterparts. Situation within a functionalist approach to STEM education policy, findings are discussed in relation to design and technology, which as a subject is caught between the identities of academic and vocational exponents, and it is from this perspective that complex nature and perceived value of design and technology is explored. © 2017 British Educational Research Association

AUTHOR KEYWORDS: curriculum development; curriculum theory; design and technology; pedagogic identity; STEM; subcultures; subject knowledge

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Williamson, K.C., IIIa , Williamson, V.M.b , Hinze, S.R.c

Administering Spatial and Cognitive Instruments In-class and On-line: Are These Equivalent?

(2017) Journal of Science Education and Technology, 26 (1), pp. 12-23.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84983436424&doi=10.1007%2fs10956-016-9645-1&partnerID=40&md5=207fac4003516d73252040602747db79

DOI: 10.1007/s10956-016-9645-1

AFFILIATIONS: Department of Construction Science, Texas A&M University, College Station, TX, United States;

Department of Chemistry, Texas A&M University, College Station, TX, United States;

Department of Psychology, Virginia Wesleyan College, Norfolk, VA, United States

ABSTRACT: Standardized, well-established paper-and-pencil tests, which measure spatial abilities or which measure reasoning abilities, have long been found to be predictive of success in the STEM (science, technology, engineering, and mathematics) fields. Instructors can use these tests for prediction of success and to inform instruction. A comparative administration of spatial visualization and cognitive reasoning tests, between in-class (proctored paper and pencil) and on-line (unproctored Internet) (N = 457), was used to investigate and to determine whether the differing instrument formats yielded equal measures of spatial ability and reasoning ability in large first-semester general chemistry sections. Although some gender differences were found, findings suggest that some differences across administration formats, but that on-line administration had similar properties of predicting chemistry performance as the in-class version. Therefore, on-line administration is a viable option for instructors to consider especially when dealing with large classes. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Chemical education research; Computer-based testing; First-year undergraduate; Reasoning abilities; Spatial abilities; Testing/assessment

DOCUMENT TYPE: Article

SOURCE: Scopus

Goy, S.C.a , Wong, Y.L.b , Low, W.Y.c , Noor, S.N.M.d , Fazli-Khalaf, Z.e , Onyeneho, N.f , Daniel, E.g , Azizan, S.d , Hasbullah, M.d , GinikaUzoigwe, A.h

Swimming against the tide in STEM education and gender equality: a problem of recruitment or retention in Malaysia

(2017) Studies in Higher Education, pp. 1-17. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010972353&doi=10.1080%2f03075079.2016.1277383&partnerID=40&md5=d03a5db13e8af8a55984bf8d5e66a511

DOI: 10.1080/03075079.2016.1277383

AFFILIATIONS: Faculty of Social Sciences, Universiti Malaysia, Sarawak, Malaysia;

Department of Social and Preventive Medicine, University of Malaya, Kuala Lumpur, Malaysia;

Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia;

Department of Science and Technology, Faculty of Science, University of Malaya, Kuala Lumpur, Malaysia;

Division of Psychology, International Medical University, Kuala Lumpur, Malaysia;

Department of Sociology and Anthropology, University of Nigeria, Nsukka, Nigeria;

Department of Mathematics and Science Education, Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia;

University of Malaya, Kuala Lumpur, Malaysia

ABSTRACT: Science, technology, engineering and mathematics (STEM) is acknowledged as one of the key drivers of technological innovation. Malaysian women join the educational pipeline as equals to their male counterparts. Nevertheless, women are persistently under-represented in technology and engineering, but over-represented in other STEM fields. Using data provided by the Malaysian Ministry of Higher Education, our results suggest that under-representation of women in engineering was attributed to low recruitment at the point of entry. Such a finding thus begs the question as to why women were not recruited into engineering. Malaysian policymakers and educators need to address under-representation of women in order to achieve gender equality in STEM, as part of the goals of Millennium Development and Vision 2020; to become a nation that is competent, confident and innovative in harnessing and advancing science and technology. © 2017 Society for Research into Higher Education

AUTHOR KEYWORDS: education; gender gap; representation; retention; STEM

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Sullivan, A., Bers, M.U.

Dancing robots: integrating art, music, and robotics in Singapore’s early childhood centers

(2017) International Journal of Technology and Design Education, pp. 1-22. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010748070&doi=10.1007%2fs10798-017-9397-0&partnerID=40&md5=572f96acbe28413c26ea53a25af17a10

DOI: 10.1007/s10798-017-9397-0

AFFILIATIONS: The DevTech Research Group at Tufts University, 105 College Ave, Medford, MA, United States

ABSTRACT: In recent years, Singapore has increased its national emphasis on technology and engineering in early childhood education. Their newest initiative, the Playmaker Programme, has focused on teaching robotics and coding in preschool settings. Robotics offers a playful and collaborative way for children to engage with foundational technology and engineering concepts during their formative early childhood years. This study looks at a sample of preschool children (N = 98) from five early childhood centers in Singapore who completed a 7-week STEAM (Science, Technology, Engineering, Arts, and Mathematics) KIBO robotics curriculum in their classrooms called, “Dances from Around the World.” KIBO is a newly developed robotics kit that teaches both engineering and programming. KIBO’s actions are programmed using tangible programming blocks—no screen-time required. Children’s knowledge of programming concepts were assessed upon completion of the curriculum using the Solve-Its assessment. Results indicate that children were highly successful at mastering foundational programming concepts. Additionally, teachers were successful at promoting a collaborative and creative environment, but less successful at finding ways to engage with the greater school community through robotics. This research study was part of a large country-wide initiative to increase the use of developmentally appropriate engineering tools in early childhood settings. Implications for the design of technology, curriculum, and other resources are addressed. © 2017 Springer Science+Business Media Dordrecht

AUTHOR KEYWORDS: Early childhood; Programming; Robotics; STEAM

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Watfa, M.K.a , Audi, D.b

Innovative virtual and collaborative teaching methodologies

(2017) Behaviour and Information Technology, pp. 1-11. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010637687&doi=10.1080%2f0144929X.2016.1275806&partnerID=40&md5=603fad4ae3eccfeae0e8a0b021dad178

DOI: 10.1080/0144929X.2016.1275806

AFFILIATIONS: Faculty of Engineering and Information Sciences, University of Wollongong in Dubai, Dubai, UAE;

Mathematics Department, American University of Sharjah, Sharjah, UAE

ABSTRACT: This collaborative research work between multiple universities demonstrates and rigorously analyses a number of innovative and new teaching methodologies that incorporate the use of new technology to encourage students to participate and take an active role in learning. More precisely, we introduce the ‘Automatic Virtual Lecturing’ teaching methodology which utilises live student feedback to dynamically reorder the lecture slides content of the teacher combined with an online video repository to substitute repeated lecture presentations both during and after class. We also present research outputs of our patented teaching concept SHARED and collaborative learning which creates a paperless collaborative learning environment in our classrooms where students can take virtual notes on their wooden tabletops, while the teacher can give instant feedback on student progress without leaving his personal desk. The methodologies were researched thoroughly in a number of classrooms which resulted in a significant increase in the performance of the students, showing real promise of such unique teaching methodologies. © 2017 Informa UK Limited, trading as Taylor & Francis Group

AUTHOR KEYWORDS: automatic lecturing; collaborative learning; innovation; mathematics teaching; Virtual lecturing

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Bevan, B.

The promise and the promises of Making in science education

(2017) Studies in Science Education, pp. 1-29. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85009953639&doi=10.1080%2f03057267.2016.1275380&partnerID=40&md5=9b7a77dca597a540d5412aed3d432888

DOI: 10.1080/03057267.2016.1275380

AFFILIATIONS: College of Education, University of Washington, Seattle, WA, USA

ABSTRACT: Making is a rapidly emerging form of educational practice that involves the design, construction, testing, and revision of a wide variety of objects, using high and low technologies, and integrating a range of disciplines including art, science, engineering, and mathematics. It has garnered widespread interest and support in both policy and education circles because of the ways it has been shown to link science learning to creativity and investigation. Making has taken root in out-of-school settings, such as museums, science festivals, and afterschool and library programmes; and there is now growing interest from primary and secondary educators in how it might be incorporated into the classroom. Making expands on traditions associated with Technology Education and Design-Based Learning, but differs in ways that can potentially broaden participation in science and STEM learning to include learners from communities historically underrepresented in STEM fields. STEM-Rich Making is centrally organised around design and engineering practices, typically integrating digital tools and computational practices, and positions scientific and mathematical concepts and phenomena as the materials for design. This paper takes a critical view of the claims about Making as a productive form of science teaching and learning, and reviews the current research literature’s substantiation of the ways in which Making supports students’ agency, promotes active participation in science and engineering practices, and leverages learners’ cultural resources. © 2017 Informa UK Limited, trading as Taylor & Francis Group

AUTHOR KEYWORDS: broadening participation; equity; inclusion; informal; Maker Education; Maker Movement; Making; practical work; STEM; tinkering

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Holmes, K.a , Gore, J.b , Smith, M.b , Lloyd, A.b

An Integrated Analysis of School Students’ Aspirations for STEM Careers: Which Student and School Factors Are Most Predictive?

(2017) International Journal of Science and Mathematics Education, pp. 1-21. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85009477594&doi=10.1007%2fs10763-016-9793-z&partnerID=40&md5=a7443322ef6362d6dd93759ffeade0d4

DOI: 10.1007/s10763-016-9793-z

AFFILIATIONS: School of Education, Western Sydney University, Sydney, Australia;

School of Education, University of Newcastle, Newcastle, Australia

ABSTRACT: Declining enrolments in science, technology, engineering and mathematics (STEM) disciplines and a lack of interest in STEM careers are concerning at a time when society is becoming more reliant on complex technologies. We examine student aspirations for STEM careers by drawing on surveys conducted annually from 2012 to 2015. School students in years 3 to 12 (n = 6492) were asked to indicate their occupational choices. A logistic regression analysis showed that being in the older cohorts, possessing high cultural capital, being male, having a parent in a STEM occupation and high prior achievement in reading and numeracy, were significant. This analysis provides a strong empirical basis for school-based initiatives to improve STEM participation. In particular, strategies should target the following: the persistent lack of interest by females in some careers, improving student academic achievement in both literacy and numeracy and expanding knowledge of STEM careers, especially for students without familial STEM connections. © 2017 Ministry of Science and Technology, Taiwan

AUTHOR KEYWORDS: Career aspiration; Gender; STEM education; Student achievement

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

McCormack, S.L., Zieman, S.

Technological Education for the Rural Community (TERC) Project: Technical Mathematics for the Advanced Manufacturing Technician

(2017) Community College Journal of Research and Practice, pp. 1-4. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85009239965&doi=10.1080%2f10668926.2016.1268078&partnerID=40&md5=d5cdeb39fda1071d2df4e55313bd20e7

DOI: 10.1080/10668926.2016.1268078

AFFILIATIONS: Department of Math and Science, Hopkinsville Community College, Hopkinsville, Kentucky, USA

ABSTRACT: Hopkinsville Community College’s Technological Education for the Rural Community (TERC) project is funded through the National Science Foundation Advanced Technological Education (NSF ATE) division. It is advancing innovative educational pathways for technological education promoted at the community college level serving rural communities to fill highly technical positions. Deficiencies in mathematics preparation and access to meaningful math program content were identified as barriers to educational attainment for the technician. Math courses were hybridized to deliver material in class with an online component. Didactic content was employed using portable media that students without Internet could use outside of class. Materials were contextualized using problem-based learning focusing on curriculum requirements relating to industry-specific problem solving with relevant examples that are of use to the technician. Interdepartmental and industrial collaborations were conducted to incorporate hands-on content from math, engineering, and technician fields. © 2017 Taylor & Francis

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Elliott, J.W.a , Thevenin, M.K.a , Bigelow, B.F.b

Promoting CM Student Success: Establishing an Academic Performance Benchmark Given Construction-Education Self-Efficacy, Motivation and Planned Behavior

(2017) International Journal of Construction Education and Research, pp. 1-15. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85009291804&doi=10.1080%2f15578771.2016.1249316&partnerID=40&md5=63586fca78788ca0b570836f95421934

DOI: 10.1080/15578771.2016.1249316

AFFILIATIONS: Colorado State University, Fort Collins, Colorado, USA;

Texas A&M University, College Station, Texas, USA

ABSTRACT: High levels of self-efficacy, motivation and intentions to perform well are necessary to achieve high grade point averages (GPA) in demanding academic programs including engineering, mathematics and the sciences. However, scant research has investigated these constructs within the domain of construction management (CM) education. The Construction Training Attitudes and Intentions Scale (CTAIS), which adapts self-efficacy, motivation and planned behavior constructs to the construction-education domain, was administered among CM and Non-CM students (n = 633) enrolled in courses required for a bachelor degree at three American Council for Construction Education accredited programs. Significant differences (p < .001) in construction-education domain-level constructs were observed for CM and Non-CM majors providing evidence of face validity. CM majors (n = 587) were separated for ANOVA. Significant differences in self-efficacy (p = .014) and planned behavior (p = .001) were observed by GPA. Post-hoc analysis revealed differences in these constructs based on GPA above, or below, 3.0. CM majors (n = 587) were aggregated using the 3.0 GPA benchmark (GPA > 3.0, n = 328; GPA< 3.0, n = 239). T-test results revealed significantly higher levels of self-efficacy (p = .001) and planned behavior (p < .001) among students with GPAs above 3.0. This study provides CM educators with a domain-specific measure to target students for interventions that promote success. Limitations and opportunities for further research are discussed. © 2017 Associated Schools of Construction

AUTHOR KEYWORDS: academic performance; Construction management; grade point average; motivation; planned behavior; self-efficacy

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Srinivas, S.a , Khanna, S.a , Rahaman, J.a , Kumar, V.b

Designing a Game-Based Learning Environment to Foster Geometric Thinking

(2016) Proceedings - IEEE 8th International Conference on Technology for Education, T4E 2016, art. no. 7814798, pp. 72-79.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013298035&doi=10.1109%2fT4E.2016.023&partnerID=40&md5=dbb0704690f95234c7c8e3e21295d9d9

DOI: 10.1109/T4E.2016.023

AFFILIATIONS: Centre for Education, Innovation and Action Research, Tata Institute of Social Sciences, Mumbai, India;

Department of Computer Science and Engineering, PES University, Bangalore, India

ABSTRACT: While there has been a steady rise in enrolment in secondary schools in recent years, many of the issues and concerns related to the quality of mathematics education have persisted. The challenges cut across several dimensions - access to resources, a gap between the intended and the implemented curriculum, and pedagogical practices that promote rote rather than reason, are a few important ones. These result in considerable learning gaps and limited opportunities for students to actively engage with the subject. In this paper, we describe the specific challenges of teaching geometry to high school students in India (as part of a project spanning four states), and argue that a carefully designed game-based learning environment, working in tandem with focused classroom discussions, could address some of the key challenges. We describe the design of our game-based learning environment and present the results of preliminary investigations that demonstrate its potential. © 2016 IEEE.

AUTHOR KEYWORDS: Game-based learning; Geometry learning in India; van Hiele levels of geometric thinking

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Kennedy, J.a , Quinn, F.a , Lyons, T.b

Australian enrolment trends in technology and engineering: putting the T and E back into school STEM

(2017) International Journal of Technology and Design Education, pp. 1-19. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85008500689&doi=10.1007%2fs10798-016-9394-8&partnerID=40&md5=b7db6d137a7cbb3f180257097c1dbd35

DOI: 10.1007/s10798-016-9394-8

AFFILIATIONS: School of Education, University of New England, Armidale, Australia;

Faculty of Education, Queensland University of Technology, Brisbane, Australia

ABSTRACT: There has been much political and educational focus on Science, Technology, Engineering and Mathematics (STEM) in Australian schools in recent years and while there has been significant research examining science and mathematics enrolments in senior high school, little is known about the corresponding trends in Technologies and engineering. Understanding these subjects is essential for educators and policy-makers alike if Australians are to embrace the challenges of an innovation economy. We have collected raw enrolment data from each of the Australian state and territory education departments from 1992 to 2014 and analysed this across five Technology and Engineering subject areas. We also consider some of the relationships between these subject areas and other areas of the STEM equation. The results of these analyses are discussed in terms of absolute enrolments, participation rates and sex balance. We have found that the total number of students in Year 12 increased year on year and that this growth is echoed, to a lesser extent, in the participation rates for design technology, food technology and engineering. Digital Technologies however, grew rapidly until 2000, after which time it has been in steady decline. We identify that while the trends mostly show growth, there is a concerning male bias to many of these subject areas. We suggest that the broadening of the upper high school curriculum, confusion surrounding vocational training enrolments, and gamesmanship of the university entrance system, may be contributing to the limited growth observed. Finally, we identify a number of important areas for further research in this key learning area. © 2017 Springer Science+Business Media Dordrecht

AUTHOR KEYWORDS: Digital technology; Engineering; Enrolment trends; Gender; High-school; STEM; Technology

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Walsh, R.

A case study of pedagogy of mathematics support tutors without a background in mathematics education

(2017) International Journal of Mathematical Education in Science and Technology, 48 (1), pp. 67-82.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84984682104&doi=10.1080%2f0020739X.2016.1220028&partnerID=40&md5=12540b3c26e7b6b0ebb268ab1e917106

DOI: 10.1080/0020739X.2016.1220028

AFFILIATIONS: Department of Mathematics & Statistics, University of Limerick, Limerick, Ireland

ABSTRACT: This study investigates the pedagogical skills and knowledge of three tertiary-level mathematics support tutors in a large group classroom setting. This is achieved through the use of video analysis and a theoretical framework comprising Rowland's Knowledge Quartet and general pedagogical knowledge. The study reports on the findings in relation to these tutors’ provision of mathematics support to first and second year undergraduate engineering students and second year undergraduate science students. It was found that tutors are lacking in various pedagogical skills which are needed for high-quality learning amongst service mathematics students (e.g. engineering/science/technology students), a demographic which have low levels of mathematics upon entering university. Tutors teach their support classes in a very fast didactic way with minimal opportunities for students to ask questions or to attempt problems. It was also found that this teaching method is even more so exaggerated in mandatory departmental mathematics tutorials that students take as part of their mathematics studies at tertiary level. The implications of the findings on mathematics tutor training at tertiary level are also discussed. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: mathematics tutor training; pedagogical content knowledge; Tertiary mathematics education; video analysis

DOCUMENT TYPE: Article

SOURCE: Scopus

Cook, S.A., Borkovitz, D.K.

Student Perceptions of a Mathematics Major for Prospective Elementary Teachers with an Inquiry‐Based Philosophy

(2017) PRIMUS, 27 (1), pp. 125-147.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84981731371&doi=10.1080%2f10511970.2016.1194341&partnerID=40&md5=ea9d77ed8bf6281dc51ad719b299e65b

DOI: 10.1080/10511970.2016.1194341

AFFILIATIONS: Department of Mathematics and Science, Wheelock College, United States

ABSTRACT: In this paper we present data from one-on-one interviews conducted with students who have taken intermediate and advanced inquiry-based mathematics courses in a program that prepares future preK-8 teachers. Many of these students entered college with a fear of math, but then gained confidence from a required introductory math course and chose to pursue a major in Mathematics for Teaching. These interviews help explain their choice to pursue this major and their general experiences in IBL math classes. These insights were used to improve our program and may also help other mathematics instructors and programs that hope to implement an inquiry-based approach in their departments. Copyright © Taylor & Francis Group, LLC.

AUTHOR KEYWORDS: elementary education; Inquiry-based learning; pre-service teachers; problem-based learning; research in undergraduate mathematics education

DOCUMENT TYPE: Article

SOURCE: Scopus

Reiss, M.J., Mujtaba, T.

Should we embed careers education in STEM lessons?

(2017) Curriculum Journal, 28 (1), pp. 137-150.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85000352204&doi=10.1080%2f09585176.2016.1261718&partnerID=40&md5=637de0c6a478b64370e08ef0a99c488d

DOI: 10.1080/09585176.2016.1261718

AFFILIATIONS: UCL Institute of Education, University College London, London, United Kingdom

ABSTRACT: Schools have a particular responsibility to introduce young people to the range of possible options for them after they leave education as few families can provide this. However, in the United Kingdom, careers education is currently not strong in most schools for a number of reasons but principally due to its low status and shifts in government policy and funding. As a result, too many young people make subject choices for post-16 study that they subsequently regret. In particular, fewer young people in the United Kingdom choose post-16 STEM subjects than might do. Yet, STEM (science, technology, engineering and mathematics) graduates are especially valued by employers. We draw on the findings of two research projects, ASPIRES and UPMAP, and argue that one way forward may be to embed careers education in STEM lessons. This can be done in ways that are respectful of and helpful to students. We recommend that an England- or UK-based project to investigate the consequences of embedding careers education in STEM lessons be undertaken. © 2016 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: Careers education; choice; gender; mathematics education; participation; science education; STEM lessons

DOCUMENT TYPE: Article

SOURCE: Scopus

Isabelle, A.D.

STEM Is Elementary: Challenges Faced by Elementary Teachers in the Era of the Next Generation Science Standards

(2017) Educational Forum, 81 (1), pp. 83-91.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85002695271&doi=10.1080%2f00131725.2016.1242678&partnerID=40&md5=dcb94bb7789075b631556fc068f73bed

DOI: 10.1080/00131725.2016.1242678

AFFILIATIONS: School of Education, State University of New York at New Paltz, New Paltz, NY, United States

ABSTRACT: For students to achieve the goals of the Next Generation Science Standards (NGSS) by Grade 12, thinking and acting like scientists and engineers must begin in the elementary grades. However, elementary teachers may find this challenging -because language arts and mathematics still dominate many classrooms—often at the expense of science. This essay examines the science skills elementary students are expected to learn and how teachers and administrators can approach the increased demands of NGSS. © 2016, Copyright © Kappa Delta Pi.

AUTHOR KEYWORDS: elementary education; Next Generation Science Standards; process skills; science education; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Haroutounian, J.

Artistic Ways of Knowing in Gifted Education: Encouraging Every Student to Think Like an Artist

(2017) Roeper Review, 39 (1), pp. 44-58.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007137538&doi=10.1080%2f02783193.2016.1247397&partnerID=40&md5=f57339bf2baad9ab05916680215f5620

DOI: 10.1080/02783193.2016.1247397

AFFILIATIONS: George Mason University, United States

ABSTRACT: After decades of fluctuating presence in gifted education, the arts are surprisingly establishing themselves in academic classrooms, spurred by arts integration with science, technology, engineering, and mathematics (STEM) curricula or science, technology, engineering, art, and mathematics (STEAM). This renewed interest provides the opportunity to recognize the artistic process as an effective way to deepen and enlarge the scope of academic content. Teachers can readily identify potentially talented students in their classrooms who immerse themselves in arts activities. Students in every classroom, if provided with substantive arts integrated curricula, can learn to perceive with discrimination, metaperceptively mold creative interpretations, and communicate these performances/products expressively to others with insightful critiques. Artistic ways of knowing mirror the artistic process and provide the opportunity for every student in every classroom to think like an artist. Copyright © The Roeper Institute.

AUTHOR KEYWORDS: artistic ways of knowing; arts, arts talent identification; gifted; gifted education; metaperception; STEAM

DOCUMENT TYPE: Article

SOURCE: Scopus

Banerjee, P.A.

Does continued participation in STEM enrichment and enhancement activities affect school maths attainment?

(2017) Oxford Review of Education, 43 (1), pp. 1-18.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84997764940&doi=10.1080%2f03054985.2016.1235031&partnerID=40&md5=83ea9149ca6baef2178ccb2fe61fa9db

DOI: 10.1080/03054985.2016.1235031

AFFILIATIONS: University of Exeter, United Kingdom

ABSTRACT: Science, technology, engineering, and mathematics (STEM) skills are very valuable for economic growth. However, the number of young people pursuing STEM learning trajectories in the United Kingdom was lower than the predicted demand during the last decade. Several STEM enrichment and enhancement activities were thus funded by the government, private, and charitable organisations to improve understanding of and raise pupil interest in these subjects. One possible way of measuring the impact of these activities in supporting pupil understanding of maths was to track the proportion of young people obtaining a ‘good’ grade in standardised national tests such as the GCSEs. Attainment is of course only one possible outcome of education but certainly a very important one because students are more likely to continue studying subjects in which they score higher. This makes maths attainment even more important as it is a pre-requisite for admission to STEM degree courses. This longitudinal study makes use of the National Pupil Database to assess the impact of these schemes on maths attainment of participating schools. Following up 300 intervention schools for five years the study shows the intervention group did not do any better than the comparator. The paper suggests further directions for research and offers recommendations for practice. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: attainment; enhancement; enrichment; Mathematics; school; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Stanford, J.S.a , Rocheleau, S.E.b , Smith, K.P.W.a , Mohan, J.b

Early undergraduate research experiences lead to similar learning gains for STEM and Non-STEM undergraduates

(2017) Studies in Higher Education, 42 (1), pp. 115-129.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84928820852&doi=10.1080%2f03075079.2015.1035248&partnerID=40&md5=835d45011f54e59837dc8bbbb58dee1e

DOI: 10.1080/03075079.2015.1035248

AFFILIATIONS: Department of Biology, Drexel University, Philadelphia, PA, United States;

Office of Undergraduate Research, Drexel University, Philadelphia, PA, United States

ABSTRACT: Undergraduate research is touted as a high-impact educational practice yielding important benefits such as increased retention and notable learning gains. Large-scale studies describing benefits of mentored research programs have focused primarily on outcomes for science, technology, engineering and mathematics (STEM) undergraduates. The Students Tackling Advanced Research (STAR) Scholars Program at Drexel University provides research experiences to freshman undergraduates in STEM and Non-STEM disciplines. In the 12 years since its establishment, the STAR Scholars Program has paired over 900 students with nearly 300 faculty mentors. Program outcomes were assessed using the URSSA (Undergraduate Research Student Self-Assessment) tool. Here the program structure, participant demographics and student outcomes are described. In addition to observing expected increases in retention and learning gains, very few statistically significant differences in learning gains and motivations for conducting research among STEM and Non-STEM student populations were found. These data suggest that early research experiences can benefit undergraduate students from both STEM and Non-STEM disciplines. © 2015 Society for Research into Higher Education.

AUTHOR KEYWORDS: freshman; learning gains; STEM; undergraduate research

DOCUMENT TYPE: Article

SOURCE: Scopus

Thomson, M.M.a , DiFrancesca, D.b , Carrier, S.c , Lee, C.d

Teaching efficacy: exploring relationships between mathematics and science self-efficacy beliefs, PCK and domain knowledge among preservice teachers from the United States

(2017) Teacher Development, 21 (1), pp. 1-20.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84980041655&doi=10.1080%2f13664530.2016.1204355&partnerID=40&md5=ba76eebbeead6cac9380a64924e6e2e8

DOI: 10.1080/13664530.2016.1204355

AFFILIATIONS: Teacher Education and Learning Sciences Department, North Carolina State University, 602 L Poe Hall, Campus Box 7801, Raleigh, NC, United States;

Mielke Family Department of Education, Lawrence University, Briggs Hall 118, Appleton, WI, United States;

Teacher Education and Learning Sciences Department, North Carolina State University, 317 F Poe Hall, Campus Box 7801, Raleigh, NC, United States;

Mathematics, Science, and Instructional Technology Education Department, East Carolina University, Flanagan 352, Campus Box 566, Greenville, NC, United States

ABSTRACT: This mixed-methods study investigated the relationships among preservice teachers’ efficacy beliefs, pedagogical content knowledge (PCK) and their domain knowledge (DK) as related to mathematics and science teaching. Quantitative results revealed that participants’ PCK was significantly correlated with their mathematics and science efficacy beliefs. Additionally, participants’ mathematics and science DK did not predict their mathematics and science personal efficacy beliefs, however, their PCK score predicted participants’ outcome expectancies. Interview analysis revealed five inter-related key themes, labeled as: Previous academic experiences, Mathematics and science PCK beliefs, Personal efficacy, Outcome expectancies and Emotions. These common themes describe participants’ views of their quality teacher training and thinking about planned instruction. Educational implications are discussed in relationship with study findings. © 2016 Teacher Development.

AUTHOR KEYWORDS: preservice teachers; STEM education; teaching beliefs; teaching knowledge

DOCUMENT TYPE: Article

SOURCE: Scopus

Zerpa, L.

The reification of mathematical notions in mathematics education: A four-stage model of concept development

(2017) International Journal of Science, Mathematics and Technology Learning, 24 (1), pp. 1-14.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85012899415&partnerID=40&md5=c5e06995e337e1d83fa2e48942e981e5

AFFILIATIONS: School of Social Sciences, Yachay Tech, Ecuador

ABSTRACT: A four-stage model of mathematical concept development is proposed in this article. The model is based on a distinction between a weak and a strong sense of reification in mathematics education. More specifically, the learner's language is reconstructed according to a distinction between the reification of functions, sets, and other mathematical concepts in terms of "constants" and the reification of those concepts in terms of "bound variables." The model is based on a detailed discussion of the traditional theory of reification, mainly due to Anna Sfard and her collaborators, as well as empirical data concerning the main difficulties experienced by students with the concepts of function and set. Furthermore, some remarkable episodes from the history of the concept of function in the twentieth century (including Schonfinkel's approach to functions) are examined from the perspective of the model. An example of reification of procedures in programming languages is also considered.

AUTHOR KEYWORDS: Epistemology of Mathematics; Logic and Mathematics Education; Mathematics; Mathematics Pedagogies

DOCUMENT TYPE: Article

SOURCE: Scopus

Fung, D.a , Kutnick, P.a b , Mok, I.a , Leung, F.a , Pok-Yee Lee, B.c , Mai, Y.Y.d , Tyler, M.T.e

Relationships between teachers’ background, their subject knowledge and pedagogic efficacy, and pupil achievement in primary school mathematics in Hong Kong: An indicative study

(2017) International Journal of Educational Research, 81, pp. 119-130.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007441070&doi=10.1016%2fj.ijer.2016.11.003&partnerID=40&md5=92b5de9180cf7d239f3b42600ef41988

DOI: 10.1016/j.ijer.2016.11.003

AFFILIATIONS: Faculty of Education, The University of Hong Kong, Runme Shaw Building, Pokfulam Road, Hong Kong;

King's College London, Department of Education and Professional Studies, London, United Kingdom;

Faculty of Education, University of Hong Kong, Pokfulam Road, Hong Kong;

Hong Kong Jockey Club, Hong Kong;

Research Triangle High School, Durham, NC, United States

ABSTRACT: This study investigates how teacher background, subject knowledge and pedagogic efficacy affect Grade 4 children's (aged 9–10) mathematical achievement in 10 primary schools in Hong Kong. Mathematics teachers were selected for their strong commitment to teaching mathematics and their pupils’ consistently high international mathematics performance. Teacher measures (i.e. level of mathematics education, teaching experience, mathematics subject knowledge, performance in mathematical operations and pedagogic efficacy) were checked for factor consistency and assessed against age-appropriate pupil mathematical achievement. The results showed that teachers were secure in their subject knowledge, and that such knowledge was related to their performance of mathematical operations, but it was high levels of pedagogic efficacy and the ability to perform age-appropriate mathematics operations (rather than subject knowledge) that positively affected their pupils’ achievement. These findings contradict ongoing international calls for the enhancement of primary school teachers’ mathematical subject knowledge, as they show pedagogic efficacy to be more strongly associated with pupil achievement. © 2016 Elsevier Ltd

AUTHOR KEYWORDS: Hong Kong; Mathematics subject matter knowledge; Pedagogic efficacy; Performance of mathematical operations; Teacher background

DOCUMENT TYPE: Article

SOURCE: Scopus

Polly, D.a , Wang, C.b , Lambert, R.b , Martin, C.b , McGee, J.R.c , Pugalee, D.d , Lehew, A.e

Supporting Kindergarten Teachers’ Mathematics Instruction and Student Achievement Through a Curriculum-Based Professional Development Program

(2017) Early Childhood Education Journal, 45 (1), pp. 121-131.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84880408539&doi=10.1007%2fs10643-013-0605-6&partnerID=40&md5=b7a18921e5d90ff9535d2cb045bbc7c7

DOI: 10.1007/s10643-013-0605-6

AFFILIATIONS: Department of Reading and Elementary Education, UNC Charlotte, COED 367, 9201 University City Blvd, Charlotte, NC, United States;

Center for Educational Measurement and Evaluation, UNC Charlotte, Charlotte, NC, United States;

Appalachian State University, Boone, NC, United States;

Center for Science, Technology, Engineering, and Mathematics (STEM) Education, UNC Charlotte, Charlotte, NC, United States;

Charlotte-Mecklenburg Schools, Charlotte, NC, United States

ABSTRACT: This study investigates the impacts of a year-long professional development program on Kindergarten teachers’ beliefs and practices and the association of these changes with student achievement in mathematics measured by curriculum-based instruments. Although teacher content knowledge was not statistically significantly different before and after participation in the program, changes in teachers’ beliefs and practices were both noticed: a trend towards discovery/connectionist orientation and student-centered practices. Teachers’ gain scores on a measure of mathematics content knowledge was positively related to the linear growth rate of student achievement. © 2013, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Common Core; Kindergarten; Mathematics education; Professional development; Reform-oriented pedagogies

DOCUMENT TYPE: Article

SOURCE: Scopus

Manches, A.a , Plowman, L.b

Computing education in children's early years: A call for debate

(2017) British Journal of Educational Technology, 48 (1), pp. 191-201.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85009181029&doi=10.1111%2fbjet.12355&partnerID=40&md5=7c8be31123ff8c4999388b630c38867d

DOI: 10.1111/bjet.12355

AFFILIATIONS: Moray House School of Education, University of Edinburgh, United Kingdom;

Moray House School of Education, College of Humanities and Social Science, University of Edinburgh, United Kingdom

ABSTRACT: International changes in policy and curricula (notably recent developments in England) have led to a focus on the role of computing education in the early years. As interest in the potential of computing education has increased, there has been a proliferation of programming tools designed for young children. While these changes are broadly to be welcomed, the pace of change has arguably led to more attention to the tools than to key questions about pedagogy. This paper proposes three areas of research (Logo; computational thinking; and teaching STEM subjects of science, technology, engineering and mathematics) that may inform computing education for young children and suggests that a greater focus on thinking skills and connections to manifestations of computers in the real world is needed. Above all, the paper calls for an informed debate about the trend towards introducing computing education to children in the early years. © 2015 British Educational Research Association

DOCUMENT TYPE: Article

SOURCE: Scopus

Kordaki, M., Berdousis, I.

Computing and STEM in Greece: Gender representation of students and teachers during the decade 2002/2012

(2017) Education and Information Technologies, 22 (1), pp. 101-124.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84941661705&doi=10.1007%2fs10639-015-9432-2&partnerID=40&md5=b7b080bb396a8f328ca395e8fff998f7

DOI: 10.1007/s10639-015-9432-2

AFFILIATIONS: Department of Cultural Technology and Communications, University of the Aegean, University Hill, Mytilene, Greece

ABSTRACT: Female student representation in Computing and Science, Technology, Engineering and Mathematics (STEM) Tertiary education is under-researched in a number of countries including Greece, while studies on female secondary level education teacher representation in Computing and STEM have not yet been reported. This study focuses on the investigation of gender representation of tertiary-level education students (freshmen, graduates, master’s degree graduates and PhD’s) and of secondary-level education teachers in Computing and STEM education during the decade 2002–2012 in Greece. A quantitative study was conducted taking into account appropriate data that emerged from the Hellenic Statistical Authority which is the national statistical service of Greece. During the studied decade:(a) Females were less prevalent than males at all levels of study in Computing and Engineering, (b) the number of males did not exceed that of females in Physics (freshmen, graduates and master’s degree holders) or in Mathematics (graduates),(c) Female teachers were less prevalent than males in Computing and STEM,(d) Computing female schoolteachers are better represented at all levels of secondary education compared to the representation of their female counterparts in the rest of the disciplines of STEM education,(e) There is no pipeline shrinkage between female freshmen and graduates of undergraduate studies in Computing and STEM and there was also no female dropout from level (undergraduate studies) to level (master’s degree studies) in Greek Computing, Physics and Engineering departments. It seems that the main problem is recruitment and not retention in Computing and STEM, despite female under-representation in most of these disciplines. © 2015, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Computing; Gender; STEM; Students; Teachers

DOCUMENT TYPE: Article

SOURCE: Scopus

Kyoung Ro, H.a , Lattuca, L.R.b , Alcott, B.c

Who Goes to Graduate School? Engineers’ Math Proficiency, College Experience, and Self-Assessment of Skills

(2017) Journal of Engineering Education, 106 (1), pp. 98-122.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010892523&doi=10.1002%2fjee.20154&partnerID=40&md5=5b544578c70bc5c99086e3c798a52825

DOI: 10.1002/jee.20154

AFFILIATIONS: Bowling Green State University, United States;

University of Michigan, United States;

University of Cambridge, United States

ABSTRACT: Background: Increasing human resources in engineering is a key concern for the United States. While some research has considered pathways to doctoral study, there is no clear empirical evidence on the role of undergraduate experiences in motivating engineers to continue to graduate school, both in engineering programs and more broadly. Purpose/Hypothesis: We investigated three influences on engineers’ decisions to enter graduate school: mathematics proficiency, self-assessments of engineering skills, and co-curricular experiences. Design/method: Using data from 1,119 engineers, we developed a hierarchical multinomial logistic model to examine engineers’ graduate school enrollment patterns. Results: Math proficiency, participation in undergraduate research, and self-assessed leadership skills are significant positive predictors of attendance in an engineering graduate program, although self-assessed teamwork skills are a negative predictor. For attendance in a nonengineering graduate school program, math proficiency, nonengineering community volunteer work, and engineering clubs were positive predictors, but none of the self-assessed skills were significant predictors. Conclusions: Our findings support past research that emphasized academic preparedness in mathematics, and further corroborate the claim that K–12 math education is a key policy lever to the engineering pipeline from undergraduate to graduate education. Our findings also indicate differences between engineering and nonengineering graduate study in relation to self-assessed skills and co-curricular experiences. Future research is needed on which types of preparation during college are needed for graduate school choice. © 2016 ASEE

AUTHOR KEYWORDS: extracurricular; mathematics; persistence; Postgraduate; professional skills

DOCUMENT TYPE: Article

SOURCE: Scopus

Isidro, S.N., Abad, F.M., Conde, M.J.R.

The influence of the choice of subjects in the entrance exam to the university in the mathematical skills of engineering students [La influencia de la elección de materias en la Prueba de Acceso a la Universidad en los conocimientos matemáticos de los estudiantes de Ingeniería]

(2017) Revista Complutense de Educacion, 28 (1), pp. 125-144.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85009960935&doi=10.5209%2frev\_RCED.2017.v28.n1.48977&partnerID=40&md5=2628ee13d071cbb2dea44cd6f77094f6

DOI: 10.5209/rev\_RCED.2017.v28.n1.48977

AFFILIATIONS: Universidad de Salamanca, Spain

ABSTRACT: The research analyzes the level of knowledge of Calculus of 402 students who are starting university reading different degrees in Engineering during the academic years 2011-2012, 2012-2012- 2013 and 2013-2014. These differences are classified taking into account the way of entrance of the students and if they have selected taking the exam on Mathematics II included in the current Spanish Access to University Examination (PAU). An anonymous questionnaire, designed by the authors, is used for this purpose. From the results of the questionnaire it the presence of four significant groups of freshman students has been determined. A first group is formed by Upper Secondary Education students who have overcome the specific Mathematics test of the PAU; a second group corresponds to Upper Secondary Education students who have not passed this test in the PAU; the third group is formed by the students who have not sat this examination, and finally the fourth group is constituted by the students coming from Vocational Training Modules. Through the use of non-parametric analysis (analysis post-hoc based in Kruskal-Wallis’ contrast), it has been determined that these four groups show a significantly different level of Calculus knowledge. This situation affects teacher’s work in the first university courses because an important didactic adaptation task is required in subjects with mathematical content in order to alleviate these deficiencies in basic mathematical skills. © 2017, Universidad Complutense de Madrid. All rights reserved.

AUTHOR KEYWORDS: Access to the University; Engineering education; Initial assessment; Mathematical education

DOCUMENT TYPE: Article

SOURCE: Scopus

Blair, E.E.a , Miller, R.B.b , Ong, M.c , Zastavker, Y.V.d

Undergraduate STEM Instructors' Teacher Identities and Discourses on Student Gender Expression and Equity

(2017) Journal of Engineering Education, 106 (1), pp. 14-43.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010880260&doi=10.1002%2fjee.20157&partnerID=40&md5=9a7c50595480f73e9689c63ab5b41638

DOI: 10.1002/jee.20157

AFFILIATIONS: Beloit College, United States;

Harvard University, United States;

TERC, United States;

Franklin W. Olin College of Engineering, United States

ABSTRACT: Background: Despite long-standing initiatives to improve gender equity across STEM fields, women's representation in undergraduate engineering programs remains low. STEM faculty, as influential gatekeepers, can promote gender inclusivity in these fields. Yet, little is known about how faculty construct their responsibilities to advance gender equity. Purpose/Hypothesis: We investigated how STEM faculty teaching first-year engineering courses constructed teacher identities and responsibilities. Our research questions included: What discourses do faculty use to construct the meaning of student gender expression in their classroom? How do faculty discursively position themselves in relation to gender equity? What teacher identities and responsibilities do they construct through these discourses?. Design/Method: Utilizing a feminist, poststructural epistemology and discursive methodology, we analyzed 18 interviews with instructors in three undergraduate engineering programs. After coding data for ways instructors talked about gender in their work with students, we analyzed how faculty constructed their teacher identities in relation to each discourse and how these positions affected their promotion of gender equity. Results: Faculty used three dominant discourses to construct student gender expression and teacher identities: gender blindness, gender acknowledgment, and gender intervention. Faculty most frequently utilized discourses acknowledging gender inequity, which often limited their responsibilities to promote equity and highlights the pernicious nature of systemic gender bias. Conclusions: Findings suggest that institutions could expand discourse and better align faculty awareness of gender inequity with meaningful, pedagogical change strategies. © 2016 ASEE

AUTHOR KEYWORDS: discourse analysis; faculty; gender; qualitative research; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Juhásova, A.a , Kazlov, I.b , Juhas, G.b , Molnár, L.c

How to model curricula and learnflows by Petri nets - A survey

(2016) ICETA 2016 - 14th IEEE International Conference on Emerging eLearning Technologies and Applications, Proceedings, art. no. 7802082, pp. 147-152.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85011283184&doi=10.1109%2fICETA.2016.7802082&partnerID=40&md5=8c0ca16e13fcb91c9c5afcdcc2452382

DOI: 10.1109/ICETA.2016.7802082

AFFILIATIONS: BIREGAL S.r.o., Bratislava, Slovakia;

Faculty of Electrical Engineering and Information Technology, Slovak University of Technology, Bratislava, Slovakia;

Interes.Institute S.r.o., Bratislava, Slovakia

ABSTRACT: Petri nets represent a prominent formal method for modeling distributed systems both visually and with sound mathematics. They are very successful in modeling different workflow processes. In particular, Petri nets can be used to model curricula including causal dependencies of courses, necessary and optional courses etc. Having a Petri net model of single courses and the model of the whole curriculum in a particular field, each run of the Petri net model will represent a possible individual learnflow of a student. In this survey we show how to construct Petri net models of courses, models of the whole curriculum and models of individual learnflows. The presented method is suitable both for planning, management and control of e-learning courses and study programs as well as for classroom courses and study programs. © 2016 IEEE.

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Listman, J.D., Dingus-Eason, J.

How to Be a Deaf Scientist: Building Navigational Capital

(2016) Journal of Diversity in Higher Education, . Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006508374&doi=10.1037%2fdhe0000049&partnerID=40&md5=79dc8ecb895584b52ab3c84e5e5a1207

DOI: 10.1037/dhe0000049

ABSTRACT: Deaf individuals are disproportionately underrepresented in science, technology, engineering, and mathematics (STEM) careers, particularly those requiring doctoral degrees. The leakage in the STEM pipeline between undergraduate enrollment and the awarding of doctoral degrees to Deaf students may be attributed, in part, to a lack of Deaf individuals in academic mentoring roles. This study examines mentoring experiences of Deaf mentees and their Deaf mentors who help them navigate in the STEM community as future Deaf scientists. The experiences of 3 Deaf mentoring dyads (Deaf mentor/Deaf mentee) working in undergraduate research laboratories are captured in this phenomenological study. Informed by a Deaf navigational capital framework, participants described the nature of their mentoring dyad and the content of navigational capital extended to Deaf mentees. Three themes emerged from this study: (a) modeling how to be a Deaf scientist; (b) promoting and fostering self-advocacy skills through inclusion and access; and, © networking with a broader community of scholars. The building of navigational capital for Deaf mentees is discussed. (PsycINFO Database Record © 2016 APA, all rights reserved).

AUTHOR KEYWORDS: Deaf; Higher education; Mentoring; STEM; Undergraduate

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Ulriksen, L., Holmegaard, H.T., Madsen, L.M.

Making sense of curriculum—the transition into science and engineering university programmes

(2016) Higher Education, pp. 1-18. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85003845708&doi=10.1007%2fs10734-016-0099-4&partnerID=40&md5=a82d3baa3642589cbcd639c652f5950c

DOI: 10.1007/s10734-016-0099-4

AFFILIATIONS: Department of Science Education, University of Copenhagen, Øster Voldgade 3, Copenhagen K, Denmark

ABSTRACT: Research on students’ transition, retention and experiences in science, technology, engineering and mathematics (STEM) has increasingly focused on identity formation and on students’ integration in the study programmes. However, studies focusing on the role of the curriculum in this process at the level of higher education are scarce. The present article analyses how the students’ transition into STEM higher education and their construction of a disciplinary identity is affected by the design of the curriculum. Twenty students entering a STEM higher education programme were followed through consecutive narrative interviews from the end of upper-secondary school and 1–3 times during first year at higher education. The data was analysed using a framework based on Bernstein’s concepts of classification and framing. Most students experienced strongly classified and strongly framed higher education programmes where the modules were isolated from each other, and the sequencing and pace made it difficult to experience the courses as meaningful. This impeded the students’ construction of a disciplinary identity. There are indications that weaker classification and framing offer the students a transition into first year where the students experienced the programmes as more meaningful. © 2016 Springer Science+Business Media Dordrecht

AUTHOR KEYWORDS: First-year experience; Science and engineering education; Student experience; Student identity; Transition

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Simpson, A.a , Maltese, A.b

“Failure Is a Major Component of Learning Anything”: The Role of Failure in the Development of STEM Professionals

(2016) Journal of Science Education and Technology, pp. 1-15. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85004073498&doi=10.1007%2fs10956-016-9674-9&partnerID=40&md5=65699d68e31d205f92dcad3b151108c8

DOI: 10.1007/s10956-016-9674-9

AFFILIATIONS: Mathematics Education, W.W. Wright School of Education, Indiana University, 201 N. Rose Avenue, Room 3254, Bloomington, IN, United States;

Science Education, Adjunct Faculty in Geological Sciences, W.W. Wright School of Education, Indiana University, 201 N. Rose Avenue, Room 3054, Bloomington, IN, United States

ABSTRACT: The term failure typically evokes negative connotations in educational settings and is likely to be accompanied by negative emotional states, low sense of confidence, and lack of persistence. These negative emotional and behavioral states may factor into an individual not pursuing a degree or career in science, technology, engineering, or mathematics (STEM). This is of particular concern considering the low number of women and underrepresented minorities pursing and working in a STEM field. Utilizing interview data with professionals across STEM, we sought to understand the role failure played in the persistence of individuals who enter and pursue paths toward STEM-related careers. Findings highlighted how participants’ experiences with failure (1) shaped their outlooks or views of failure, (2) shaped their trajectories within STEM, and (3) provided them with additional skills or qualities. A few differences based on participants’ sex, field, and highest degree also manifested in our analysis. We expect the results from this study to add research-based results to the current conversation around whether experiences with failure should be part of formal and informal educational settings and standards-based practices. © 2016 Springer Science+Business Media New York

AUTHOR KEYWORDS: Career; Education; Failure; Persistence; STEM

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

King, D., English, L.D.

Engineering design in the primary school: applying stem concepts to build an optical instrument

(2016) International Journal of Science Education, 38 (18), pp. 2762-2794.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007271715&doi=10.1080%2f09500693.2016.1262567&partnerID=40&md5=2911ded9f0c65ab74612f56bde281f09

DOI: 10.1080/09500693.2016.1262567

AFFILIATIONS: Faculty of Education, Queensland University of Technology, Brisbane, Australia

ABSTRACT: Internationally there is a need for research that focuses on STEM (Science, Technology, Engineering and Mathematics) education to equip students with the skills needed for a rapidly changing future. One way to do this is through designing engineering activities that reflect real-world problems and contextualise students’ learning of STEM concepts. As such, this study examined the learning that occurred when fifth-grade students completed an optical engineering activity using an iterative engineering design model. Through a qualitative methodology using a case study design, we analysed multiple data sources including students’ design sketches from eight focus groups. Three key findings emerged: first, the collaborative process of the first design sketch enabled students to apply core STEM concepts to model construction; second, during the construction stage students used experimentation for the positioning of lenses, mirrors and tubes resulting in a simpler ‘working’ model; and third, the redesign process enabled students to apply structural changes to their design. The engineering design model was useful for structuring stages of design, construction and redesign; however, we suggest a more flexible approach for advanced applications of STEM concepts in the future. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: engineering; mathematics; primary; science; sociocultural; STEM; technology

DOCUMENT TYPE: Article

SOURCE: Scopus

Gabriel, B., Valente, R., Dias-De-Oliveira, J., Neto, V., Andrade-Campos, A.

Methodologies for Engineering Learning and Teaching (MELT) approach: A way to bring young people to science (and science to young people)

(2016) CISPEE 2016 - 2nd International Conference of the Portuguese Society for Engineering Education, Proceedings, art. no. 7777724, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010303866&doi=10.1109%2fCISPEE.2016.7777724&partnerID=40&md5=35d64d6f225f3f2a0518aca0a0313089

DOI: 10.1109/CISPEE.2016.7777724

AFFILIATIONS: SEE Group, Department of Mechanical Engineering, University of Aveiro, Aveiro, Portugal

ABSTRACT: The goal of the Methodologies for Engineering Learning and Teaching (MELT) approach is to enhance the attractiveness of education through science, technology, engineering and mathematics subjects, while promoting awareness of STEM careers during upper secondary school. As a consequence, its main goal is to take into account students' aspirations and expectations during university programs and beyond, leading to an increased engagement in STEM careers. To accomplish these goals, a new, innovative and connected approach is presented, with a concept that encompasses the main stakeholders in scientific education, along with the main actors in society. A global and scalable education framework model is presented, aiming to provide guidelines for an improved collaborative approach to STEM education in the future. © 2016 IEEE.

AUTHOR KEYWORDS: Engineering Education; Stakeholders Engagement; STEM Careers

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Oliveira, M.J., Freitas, A.

Support system for learning mathematics in engineering higher education programmes: The case of the 'Mathematics Digital Practice Office'

(2016) CISPEE 2016 - 2nd International Conference of the Portuguese Society for Engineering Education, Proceedings, art. no. 7777737, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010390662&doi=10.1109%2fCISPEE.2016.7777737&partnerID=40&md5=b50995b3e19a1f384d9c463f5a62f14b

DOI: 10.1109/CISPEE.2016.7777737

AFFILIATIONS: Faculty of Engineering, University of Porto, Porto, Portugal

ABSTRACT: In 2013, a program called 'Mathematics Digital Practice Office' (CDM), was created at the School of Engineering of the University of Porto (FEUP). Its goals were to offer the students of mathematical courses (curricular units), more opportunities (besides contact hours/classes) to train the exercises, to clarify remaining and last minute doubts and to test their knowledge on the subjects throughout the semester, with the purpose of increasing academic success and mitigating dropout rates in mathematics curricular units/courses. In this scope, a program was implemented, covering, now, 642 students of six mathematics courses of engineering programs. It aims to provide additional support to the face-to-face classes, based on a distance education system, using technology and social networks to enhance learning, with multiple learning strategies (forum, videoconferences, multiple-choice tests, materials repository, etc). For the evaluation of the impact of this initiative, data was collected from different methods allowing us to realize that students are highly satisfied with the initiative and how it is being implemented, that they recognize the importance of the program for their academic success. Regarding students' academic results, the collected data revealed that final grades have increased, for all courses, since the CDM program has been implemented, as well as approval rates. Dropout rates after the first test are lower in courses supported by CDM. The main contribution of this work, is to describe how, in a high and constant academic failure and still relatively high dropout context, a distance learning program - able to be replicated in any course of any given higher education institution - was created and successfully mitigated this situation with the use of virtual platforms and social media to enhance formative assessment. © 2016 IEEE.

AUTHOR KEYWORDS: academic success; distance learning; educational technology; Engineering; mathematics

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Catarino, P.a b c , Nascimento, M.M.a b , Morais, E.a c , Campos, H.a b , Vasco, P.a c

Mathematical creativity's understanding in engineering students of a Portuguese university

(2016) CISPEE 2016 - 2nd International Conference of the Portuguese Society for Engineering Education, Proceedings, art. no. 7777730, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010427090&doi=10.1109%2fCISPEE.2016.7777730&partnerID=40&md5=133297ed1d429b647be942862931c470

DOI: 10.1109/CISPEE.2016.7777730

AFFILIATIONS: Departamento de Matemática da Escola de Ciencias e Tecnologia da UTAD, Vila Real, Portugal;

Lab-DCT Do CIDTFF, Aveiro, Portugal;

CMAT-UTAD, Polo Do CMAT, Vila Real, Portugal

ABSTRACT: Among today's attributes required to engineers is creativity. From the creativity domain, this work focused in mathematical creativity, since we teach students in Mathematics courses. This paper presents the study of 61 students' understanding of mathematical creativity of four engineering degrees that were in first year of a northeastern Portuguese university and we analyzed their texts to an open question in a Google Drive Form: "What do you understand by mathematical creativity?" Data collection was done in the first semester of 2014/2015 in the Linear Algebra course. The content analysis of students' answers focused on their texts led to three main categories that were crossed with students' gender, age, degree, and their liking for Mathematics. The results showed that "problem solving" category had the majority of the references, and there were no differences between the proportions of the categories by gender, age or liking mathematics or even independency. This exploratory study leaves clues about the connection that needs to be made between mathematical creativity and solving problems, in order to foster it in Mathematics courses in engineering degrees. © 2016 IEEE.

AUTHOR KEYWORDS: Creativity; engineering; higher education; mathematical creativity

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Abreu, S., Caldeira, A., Costa, A.R., Gomes, T., Roque, L.A.C.

Interdisciplinary team work: Applying working methods to a math project

(2016) CISPEE 2016 - 2nd International Conference of the Portuguese Society for Engineering Education, Proceedings, art. no. 7777729, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010460291&doi=10.1109%2fCISPEE.2016.7777729&partnerID=40&md5=6b5bdd23b182fe86d1ae02090cbb075e

DOI: 10.1109/CISPEE.2016.7777729

AFFILIATIONS: School of Engineering, Polytechnic of Porto, ISEP, LEMA, SYSTEC -ISR, Porto, Portugal

ABSTRACT: In this work, we describe an interdisciplinary teaching experiment involving three subjects of the scientific area of Mathematics and a fourth one in the area of Management. Using only one project, the students developed skills, in an integrated way, in the fields of the subjects involved. The structure of the project is described in detail. It is shown how the knowledge obtained in the different subjects is needed and how it connects together to answer the proposed challenges. We report the progress of the students' work, the main difficulties and the skills developed during this process. We conclude with a reflection on the main problems and gains that may arise in projects of this kind. © 2016 European Union.

AUTHOR KEYWORDS: Interdisciplinarity; mathematics teaching; soft skills; team work; working methods

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

CISPEE 2016 - 2nd International Conference of the Portuguese Society for Engineering Education, Proceedings

(2016) CISPEE 2016 - 2nd International Conference of the Portuguese Society for Engineering Education, Proceedings, 172 p.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010384466&partnerID=40&md5=b9986705d1d3a0bd3c5b09f361e2b619

ABSTRACT: The proceedings contain 25 papers. The topics discussed include: increasing adult students' learning opportunities with flexible learning pathways: evidence from a technology and industrial management graduate course; experimental classes of metallic materials challenges in identifying steel components; motivating first year students for an engineering degree; designing experiments with aspen HYSYS simulation to improve distillation systems; methodologies for engineering learning and teaching (MELT) approach - a way to bring young people to science (and science to young people); reconceptualizing planning - conceiving new ways of planning educational processes with authoring tools; include ethic education in the engineering courses' curriculum - the students' perspec; Portuguese and Brazilian students perceptions regarding the flow of knowledge in their courses - two different realities?; mathematical creativity definitions in engineering students in a portuguese university; a learning toolkit to promote creative and critical thinking in product design and development through design thinking; using the finite element method to understand calculus; take this waltz on creativity - the engineering students' conceptions; critical thinking for engineers and engineering critical thinking; and support system for learning mathematics in engineering higher education programmes the case of the "mathematics digital practice office.

DOCUMENT TYPE: Conference Review

SOURCE: Scopus

Alves, G.R., Fidalgo, A., Marques, A., Viegas, C., Felgueiras, M.C., Costa, R., Lima, N., Castro, M., Díaz-Orueta, G., Ruiz, E.S.C., García-Loro, F., García-Zubía, J., Hernández-Jayo, U., Kulesza, W., Gustavsson, I., Pester, A., Zutin, D., Schlichting, L., Ferreira, G., De Bona, D., Da Silva, J.B., Alves, J.B., Biléssimo, S., Pavani, A., Lima, D., Temporão, G., Marchisio, S., Concari, S., Lerro, F., Fernández, R., Paz, H., Soria, F., Almeida, N., De Oliveira, V., Pozzo, M.I., Dobboletta, E.

Spreading remote lab usage: A system - A community - A Federation

(2016) CISPEE 2016 - 2nd International Conference of the Portuguese Society for Engineering Education, Proceedings, art. no. 7777722, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010369433&doi=10.1109%2fCISPEE.2016.7777722&partnerID=40&md5=3c16a70045c43abb44ae7065cab2d8ef

DOI: 10.1109/CISPEE.2016.7777722

AFFILIATIONS: VISIR+ Project, Polytechnic of Porto, National Distance Education University, University of Deusto, Blekinge Institute of Technology, Carinthia University of Applied Sciences, Federal Institute of Santa Catarina, Federal University of Santa Catarina, Pontifical Catholic University of Rio de Janeiro, National University of Rosario, Brazil

ABSTRACT: Experiments have been at the heart of scientific development and education for centuries. From the outburst of Information and Communication Technologies, virtual and remote labs have added to hands-on labs a new conception of practical experience, especially in Science, Technology, Engineering and Mathematics education. This paper aims at describing the features of a remote lab named Virtual Instruments System in Reality, embedded in a community of practice and forming the spearhead of a federation of remote labs. More particularly, it discusses the advantages and disadvantages of remote labs over virtual labs as regards to scalability constraints and development and maintenance costs. Finally, it describes an actual implementation in an international community of practice of engineering schools forming the embryo of a first world wide federation of Virtual Instruments System in Reality nodes, under the framework of a project funded by the Erasmus+ Program. © 2016 IEEE.

AUTHOR KEYWORDS: Community of Practice; Engineering education; online labs federation; remote labs; VISIR; VISIR+1

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Remijan, K.W.

Project-based learning and design-focused projects to motivate secondary mathematics students

(2016) Interdisciplinary Journal of Problem-based Learning, 11 (1), art. no. 2, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006409365&doi=10.7771%2f1541-5015.1520&partnerID=40&md5=3f2e0fc83caa1b716f8937f63daafcd9

DOI: 10.7771/1541-5015.1520

AFFILIATIONS: O’Fallon Township High School, Saint Louis University, O’Fallon, IL, United States

ABSTRACT: This article illustrates how mathematics teachers can develop design-focused projects, related to project-based learning, to motivate secondary mathematics students. With first-hand experience as a secondary mathematics teacher, I provide a series of steps related to the engineering design process, which are helpful to teachers in developing design-focused projects, describe various projects that have been developed and implemented within my classroom, and share project artifacts illustrated by pictures, student work, and student comments. Referring to the MUSIC Model of Academic Motivation and reflecting upon personal observations, student outcomes, and student comments, I provide personal insight on how designfocused projects can be perceived to enhance student motivation within the mathematics classroom. © 2016, Purdue University Press. All rights reserved.

AUTHOR KEYWORDS: Design; Mathematics; Motivation; Project-based learning; Secondary education

DOCUMENT TYPE: Article

SOURCE: Scopus

Muir, T., Beswick, K., Callingham, R., Jade, K.

Experiencing teaching and learning quantitative reasoning in a project-based context

(2016) Mathematics Education Research Journal, 28 (4), pp. 479-501.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84997112198&doi=10.1007%2fs13394-016-0176-0&partnerID=40&md5=7fa1e5005eb6c245f22faff8da6473be

DOI: 10.1007/s13394-016-0176-0

AFFILIATIONS: University of Tasmania, Launceston, Australia

ABSTRACT: This paper presents the findings of a small-scale study that investigated the issues and challenges of teaching and learning about quantitative reasoning (QR) within a project-based learning (PjBL) context. Students and teachers were surveyed and interviewed about their experiences of learning and teaching QR in that context in contrast to teaching and learning mathematics in more traditional settings. The grade 9–12 student participants were characterised by a history of disengagement with mathematics and school in general, and the teacher participants were non-mathematics specialist teachers. Both students and teachers were new to the PjBL situation, which resulted in the teaching/learning relationship being a reciprocal one. The findings indicated that students and teachers viewed QR positively, particularly when compared with traditional mathematics teaching, yet tensions were identified for aspects such as implementation of curriculum and integration of relevant mathematics into projects. Both sets of participants identified situations where learning QR was particularly successful, along with concerns or difficulties about integrating QR into project work. The findings have implications for educators, who may need to examine their own approaches to mathematics teaching, particularly in terms of facilitating student engagement with the subject. © 2016, Mathematics Education Research Group of Australasia, Inc.

AUTHOR KEYWORDS: Big Picture; Engagement; Motivation; Project-based learning; Quantitative reasoning

DOCUMENT TYPE: Article

SOURCE: Scopus

Skilling, K.a , Bobis, J.b , Martin, A.J.c , Anderson, J.b , Way, J.b

What secondary teachers think and do about student engagement in mathematics

(2016) Mathematics Education Research Journal, 28 (4), pp. 545-566.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84997482205&doi=10.1007%2fs13394-016-0179-x&partnerID=40&md5=23b12e05d73e2e1e815a51aaf0adc5df

DOI: 10.1007/s13394-016-0179-x

AFFILIATIONS: King’s College London, Waterloo Bridge Wing, Franklin-Wilkins Building, Waterloo Road, London, United Kingdom;

The University of Sydney, Education Building, A35, Sydney, NSW, Australia;

University of NSW, Goodsell Building, Kensington Campus, Kensington, NSW, Australia

ABSTRACT: What teachers’ think about student engagement influences the teaching practices they adopt, their responses to students and the efforts they make in the classroom. Interviews were conducted with 31 mathematics teachers from ten high schools to investigate their perceptions and beliefs about student engagement in mathematics. Teachers also reported the practices they used to engage their students during mathematics lessons. Teacher perceptions of student engagement were categorised according to recognised ‘types’ (behavioural, emotional and cognitive) and ‘levels’ (ranging from disengaged to engaged). The teachers’ reports emphasised immediate attention being paid to students’ behaviours and overt emotions towards mathematics with fewer and less extensive reports made about students’ cognitive engagement. Teachers’ abilities to implement practices considered supportive of student engagement were linked to a number of elements, including their self-efficacy. Perceptions of being powerless to engage their students resulted in many teachers limiting their efforts to attempt some form of intervention. © 2016, Mathematics Education Research Group of Australasia, Inc.

AUTHOR KEYWORDS: Mathematics; Student engagement; Teacher beliefs and practices; Teacher self-efficacy

DOCUMENT TYPE: Article

SOURCE: Scopus

Kytmanov, A.A., Noskov, M.V., Safonov, K.V., Savelyeva, M.V., Shershneva, V.A.

Competency-based learning in higher mathematics education as a cluster of efficient approaches

(2016) Bolema - Mathematics Education Bulletin, 30 (56), pp. 1113-1126.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006456821&doi=10.1590%2f1980-4415v30n56a14&partnerID=40&md5=141588be4b17ae6ae2e3174e20c3d179

DOI: 10.1590/1980-4415v30n56a14

AFFILIATIONS: Siberian Federal University, Department of Applied Mathematics and Computer Security, 79 Svo-bodny av., Krasnoyarsk, Russian Federation

ABSTRACT: This paper presents the research results of what the process of mathematics teaching should be under the competency-based approach allowing the development of a university student's mathematical competency. It indicates that integrative structure of mathematical competency containing cognitive, practical, motivational and value-based, reflexive and assessment-based components, updates the polyparadigm approach in teaching mathematics as an open cluster of approaches; their integrated utilization under the leading role of competency-based ap-proach contributes to developing all mathematical competency components. It justifies that competency-based, context-based, interdisciplinary, discipline-based and information technology approaches and fundamentalization play a critical part in the polyparadigm approach; the integrated utilization of all approaches results in a synergetic effect. Within this framework the basic principles of competency-based mathematics teaching as well as a coherent system to select the content of mathematics teaching for engineering educational institution students are developed.

AUTHOR KEYWORDS: Cluster of approaches; Didactic basis; Mathematical competency; Polyparadigm approach; System to select the content of mathematics teaching

DOCUMENT TYPE: Article

SOURCE: Scopus

Ashford, S.N.a , Lanehart, R.E.b , Kersaint, G.K.c , Lee, R.S.b , Kromrey, J.D.b

STEM Pathways: Examining Persistence in Rigorous Math and Science Course Taking

(2016) Journal of Science Education and Technology, 25 (6), pp. 961-975.

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AFFILIATIONS: Department of Occupational, Workforce, and Leadership Studies, Texas State University, 601 University Drive, Pedernales Building 110, San Marcos, TX, United States;

Center for Research, Evaluation, Assessment, and Measurement, University of South Florida, 4202 E. Fowler Avenue, EDU 105, Tampa, FL, United States;

Neag School of Education, University of Connecticut, 249 Glenbrook Road, Unit 3064, Charles B. Gentry Building, Storrs, CT, United States

ABSTRACT: From 2006 to 2012, Florida Statute §1003.4156 required middle school students to complete electronic personal education planners (ePEPs) before promotion to ninth grade. The ePEP helped them identify programs of study and required high school coursework to accomplish their postsecondary education and career goals. During the same period Florida required completion of the ePEP, Florida’s Career and Professional Education Act stimulated a rapid increase in the number of statewide high school career academies. Students with interests in STEM careers created STEM-focused ePEPs and may have enrolled in STEM career academies, which offered a unique opportunity to improve their preparedness for the STEM workforce through the integration of rigorous academic and career and technical education courses. This study examined persistence of STEM-interested (i.e., those with expressed interest in STEM careers) and STEM-capable (i.e., those who completed at least Algebra 1 in eighth grade) students (n = 11,248), including those enrolled in STEM career academies, in rigorous mathematics and science course taking in Florida public high schools in comparison with the national cohort of STEM-interested students to measure the influence of K-12 STEM education efforts in Florida. With the exception of multi-race students, we found that Florida’s STEM-capable students had lower persistence in rigorous mathematics and science course taking than students in the national cohort from ninth to eleventh grade. We also found that participation in STEM career academies did not support persistence in rigorous mathematics and science courses, a prerequisite for success in postsecondary STEM education and careers. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Career academies; Electronic personal education planner; Persistence; Rigorous math and science course taking; STEM-capable

DOCUMENT TYPE: Article

SOURCE: Scopus

Ngah, N., Ismail, Z., Tasir, Z., Mohamad Said, M.N.H.

Students’ ability in free, semi-structured and structured problem posing situations

(2016) Advanced Science Letters, 22 (12), pp. 4205-4208.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85011982901&doi=10.1166%2fasl.2016.8106&partnerID=40&md5=a5bac3b99e5b8b1a7ef80d1666e405fc

DOI: 10.1166/asl.2016.8106

AFFILIATIONS: Department of Educational Sciences, Mathematics and Creative Multimedia, Faculty of Education, Universiti Teknologi Malaysia, Malaysia

ABSTRACT: Problem posing is a new and inventive pedagogical approach in mathematics education. It has long been under the shadow of problem solving, until recently, when researchers started to realize its potentials, resulting in a fastgrowing recognition of the need to incorporate it into Mathematics classroom learning. Therefore, the purpose of this study was to identify students’ problem posing ability in free, semi-structured and structured problem posing situations. In addition, this study would also determine their view about problem posing. The sample consisted of twenty eight Form 2 secondary school students. Two instruments were used: The Mathematical Problem Posing Task and The Problem Posing Questionnaire. The results revealed that the students were capable of posing 63 solvable mathematical problems, out of which, 55 (87%) in the low level of complexity and 8 (13%) in the moderate level of complexity, within the problem posing tasks given. The result also revealed that, free problem posing situations are more demanding task compared to the semi-structured and structured problem posing situations. Besides, the findings also found that, students have positive views about problem posing. In conclusion, problem posing is a potential pedagogical approach that can be implemented realistically in Mathematics classrooms. © 2016 American Scientific Publishers All rights reserved.

AUTHOR KEYWORDS: Free problem posing situations; Mathematics education; Problem posing ability; Problem posing tasks; Semi-structured problem posing situations; Structured problem posing situations

DOCUMENT TYPE: Article

SOURCE: Scopus

Makonye, J.P.a , Fakude, J.b

A Study of Errors and Misconceptions in the Learning of Addition and Subtraction of Directed Numbers in Grade 8

(2016) SAGE Open, 6 (4), .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85008698666&doi=10.1177%2f2158244016671375&partnerID=40&md5=e4215cf94333ae6b3065f99fecc0a85c

DOI: 10.1177/2158244016671375

AFFILIATIONS: University of the Witwatersrand, Johannesburg, South Africa;

Jacob Mdluli High School, Nelspruit, South Africa

ABSTRACT: The study focused on the errors and misconceptions that learners manifest in the addition and subtraction of directed numbers. Skemp’s notions of relational and instrumental understanding of mathematics and Sfard’s participation and acquisition metaphors of learning mathematics informed the study. Data were collected from 35 Grade 8 learners’ exercise book responses to directed numbers tasks as well as through interviews. Content analysis was based on Kilpatrick et al.’s strands of mathematical proficiency. The findings were as follows: 83.3% of learners have misconceptions, 16.7% have procedural errors, 67% have strategic errors, and 28.6% have logical errors on addition and subtraction of directed numbers. The sources of the errors seemed to be lack of reference to mediating artifacts such as number lines or other real contextual situations when learning to deal with directed numbers. Learners seemed obsessed with positive numbers and addition operation frames—the first number ideas they encountered in school. They could not easily accommodate negative numbers or the subtraction operation involving negative integers. Another stumbling block seemed to be poor proficiency in English, which is the language of teaching and learning mathematics. The study recommends that building conceptual understanding on directed numbers and operations on them must be encouraged through use of multirepresentations and other contexts meaningful to learners. For that reason, we urge delayed use of calculators. © 2016, © The Author(s) 2016.

AUTHOR KEYWORDS: communication; curriculum; education; mathematics; perceptions; social sciences

DOCUMENT TYPE: Article

SOURCE: Scopus

Mulnix, A.B.

STEM faculty as learners in pedagogical reform and the role of research articles as professional development opportunities

(2016) CBE Life Sciences Education, 15 (4), art. no. es8, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994761829&doi=10.1187%2fcbe.15-12-0251&partnerID=40&md5=d75cd41c1fec9f095da4431a654ff1a1

DOI: 10.1187/cbe.15-12-0251

AFFILIATIONS: Franklin and Marshall College, Lancaster, PA, United States

ABSTRACT: Discipline-based education research (DBER) publications are opportunities for professional development around science, technology, engineering, and mathematics (STEM) education reform. Learning theory tells us these publications could be more impactful if authors, reviewers, and editors pay greater attention to linking principles and practice. This approach, which considers faculty as learners and STEM education reform as content, has the potential to better support faculty members because it promotes a deeper understanding of the reasons why a pedagogical change is effective. This depth of understanding is necessary for faculty members to successfully transfer new knowledge to their own contexts. A challenge ahead for the emergent learning sciences is to better integrate findings from across sister disciplines; DBER reports can take a step in that direction while improving their usefulness for instructors. © 2016 A. B. Mulnix.

DOCUMENT TYPE: Article

SOURCE: Scopus

Alexander, Q.R.a b , Hermann, M.A.a

African-American Women's Experiences in Graduate Science, Technology, Engineering, and Mathematics Education at a Predominantly White University: A Qualitative Investigation

(2016) Journal of Diversity in Higher Education, 9 (4), pp. 307-322.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84946854915&doi=10.1037%2fa0039705&partnerID=40&md5=c87d45b51c24e385f2e2d5d25ac53052

DOI: 10.1037/a0039705

AFFILIATIONS: Department of Counselor Education, Virginia Commonwealth University, United States;

Department of Education and Special Education, College of Education and Human Services, Longwood University, 201 High Street, Farmville, VA, United States

ABSTRACT: In this phenomenological investigation we used qualitative research methodology to examine the experiences of 8 African American women in science, technology, engineering, and mathematics (STEM) graduate programs at 1 predominantly White university (PWU) in the South. Much of the current research in this area uses quantitative methods and only yields descriptive statistical information. By using qualitative methods, we sought to add significant context to currently available literature about the experiences of African American women in STEM graduate programs at PWUs. We conducted semistructured interviews with research participants. Additionally, participants completed a demographic questionnaire to give us more information about their backgrounds. We analyzed these sources of data to help understand participant experiences. Verbatim quotes from participant interviews were used to highlight experiences and give voice to an often silenced student population in graduate STEM education. Results indicated that participants experienced racial microaggressions, low self-efficacy, and a lack of institutional support while pursuing STEM graduate degrees at this PWU. We offer suggestions about ways issues revealed by participants might be addressed by PWU university personnel. Attention to these issues could make the experiences for African American women more positive while pursuing graduate STEM degrees. © 2015 National Association of Diversity Officers in Higher Education.

AUTHOR KEYWORDS: African-American women; graduate education; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Qazi, M.A.a , Shannon, D.M.b , Jenda, O.c , McCullough, B.d , Griffin, G.e , Lunn, A.M.f

A mentoring bridge model to prepare students with disabilities in the stem fields at Tuskegee university

(2016) Journal of Women and Minorities in Science and Engineering, 22 (3), pp. 183-197.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006375044&partnerID=40&md5=592a3fc60e82152b4d1e68351cd574de

AFFILIATIONS: Department of Mathematics, Tuskegee University, Tuskegee, AL, United States;

Department of Educational Foundations, Leadership, and Technology, Auburn University, Auburn, AL, United States;

Department of Mathematics and Statistics, Auburn University, Auburn, AL, United States;

Office of the Provost-Special Projects and Initiatives, Auburn University, Auburn, AL, United States;

Departments of Biology & Psychology, Hope College, Holland, MI, United States;

Counseling Center, Tuskegee University, Tuskegee, AL, United States

ABSTRACT: This article seeks to describe programmatic elements of a successful novel model established at Tuskegee University, one of the oldest Historically Black Institutions in the country, to increase degree production among students with disabilities in Science, Technology, Engineering and Mathematics (STEM) and their representation in the STEM workforce. Qualitative and quantitative program outcomes are discussed. © 2016 by Begell House, Inc.

AUTHOR KEYWORDS: Broadening participation; Higher education; Mentoring bridge model; STEM fields; Students with disabilities

DOCUMENT TYPE: Article

SOURCE: Scopus

Rowland, S., Pedwell, R., Lawrie, G., Lovie-Toon, J., Hung, Y.

Do we need to design course-based undergraduate research experiences for authenticity?

(2016) CBE Life Sciences Education, 15 (4), art. no. ar79, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85003906035&doi=10.1187%2fcbe.16-02-0102&partnerID=40&md5=238cc04d850255b68b5d93fa471c9af5

DOI: 10.1187/cbe.16-02-0102

AFFILIATIONS: School of Chemistry and Molecular Biosciences, University of Queensland, St. Lucia, QLD, Australia

ABSTRACT: The recent push for more authentic teaching and learning in science, technology, engineering, and mathematics indicates a shared agreement that undergraduates require greater exposure to professional practices. There is considerable variation, however, in how “authentic” science education is defined. In this paper we present our definition of authenticity as it applies to an “authentic” large-scale undergraduate research experience (ALURE); we also look to the literature and the student voice for alternate perceptions around this concept. A metareview of science education literature confirmed the inconsistency in definitions and application of the notion of authentic science education. An exploration of how authenticity was explained in 604 reflections from ALURE and traditional laboratory students revealed contrasting and surprising notions and experiences of authenticity. We consider the student experience in terms of alignment with 1) the intent of our designed curriculum and 2) the literature definitions of authentic science education. These findings contribute to the conversation surrounding authenticity in science education. They suggest two things: 1) educational experiences can have significant authenticity for the participants, even when there is no purposeful design for authentic practice, and 2) the continuing discussion of and design for authenticity in UREs may be redundant. © 2016 The American Society for Cell Biology.

DOCUMENT TYPE: Article

SOURCE: Scopus

Ismail, R.a , Ismail, Z.a , Yusof, Y.M.b

Blended learning environment in tertiary education: A meta-analysis

(2016) Advanced Science Letters, 22 (12), pp. 4263-4266.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85011948995&doi=10.1166%2fasl.2016.8122&partnerID=40&md5=b98c6845151e4ad70aee6df052fb4f00

DOI: 10.1166/asl.2016.8122

AFFILIATIONS: Department of Educational Science, Mathematics and Creative Multimedia, Faculty of Education, UTM, Skudai, Johor, Malaysia;

Department of Mathematical Science, Faculty of Science, Universiti Teknologi Malaysia, UTM, Skudai, Johor, Malaysia

ABSTRACT: There are many ways to implement blended learning, among them are online learning, e-learning, mathematical softwares, and web-based learning. For new practitioners, it is important to determine the best practices in blended learning system to ensure successes. This paper studies a meta-analysis of a blended environment. It was conducted by searching previous studies between 2000 to present (2016), which used some keywords such as mathematical competency and blended learning. The aims of this meta-analysis are to investigate the types of blended learning implemented in the tertiary education, especially in mathematics education and their impact towards learning. The result shows e-learning most frequently used within 2000 to present. The embedded e-learning as a mediated-technology tool in a blended environment assists of conceptual understanding, especially in engineering courses and makes it easier to seek the solution in problem-solving. © 2016 American Scientific Publishers All rights reserved.

AUTHOR KEYWORDS: Blended learning; E-learning; Tertiary education

DOCUMENT TYPE: Article

SOURCE: Scopus

Matz, R.L.a , Jardeleza, S.E.b c

Examining the role of leadership in an undergraduate biology institutional reform initiative

(2016) CBE Life Sciences Education, 15 (4), art. no. ar57, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84996486571&doi=10.1187%2fcbe.15-10-0222&partnerID=40&md5=98d5275da0e57de89528328fe8840b69

DOI: 10.1187/cbe.15-10-0222

AFFILIATIONS: CREATE for STEM Institute, Michigan State University, East Lansing, MI, United States;

CREATE for STEM Institute, Center for Integrative Studies in General Science, Michigan State University, East Lansing, MI, United States;

Salisbury University, Office of University Analysis,Reporting and Assessment, 1101 Camden Avenue, Salisbury, MD, United States

ABSTRACT: Undergraduate science,technology,engineering,and mathematics (STEM) education reform continues to be a national priority. We studied a reform process in undergraduate biology at a research-intensive university to explore what leadership issues arose in implementation of the initiative when characterized with a descriptive case study method. The data were drawn from transcripts of meetings that occurred over the first 2 years of the reform process. Two literature-based models of change were used as lenses through which to view the data. We find that easing the burden of an undergraduate education reform initiative on faculty through articulating clear outcomes,developing shared vision across stakeholders on how to achieve those outcomes,providing appropriate reward systems,and ensuring faculty have ample opportunity to influence the initiative all appear to increase the success of reform. The two literature-based models were assessed,and an extended model of change is presented that moves from change in STEM instructional strategies to STEM organizational change strategies. These lessons may be transferable to other institutions engaging in education reform. © 2016 R. L. Matz and S. E. Jardeleza.

DOCUMENT TYPE: Article

SOURCE: Scopus

Connors-Kellgren, A.a , Parker, C.E.b , Blustein, D.L.a , Barnett, M.a

Innovations and Challenges in Project-Based STEM Education: Lessons from ITEST

(2016) Journal of Science Education and Technology, 25 (6), pp. 825-832.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994475011&doi=10.1007%2fs10956-016-9658-9&partnerID=40&md5=b2517bb6585a42345a56dd78c3ce2a84

DOI: 10.1007/s10956-016-9658-9

AFFILIATIONS: Boston College Lynch School of Education, Chestnut Hill, Boston, MA, United States;

STEM Learning and Research (STELAR) Center at EDC, Waltham, MA, United States

ABSTRACT: For over a decade, the National Science Foundation’s Innovative Technology Experiences for Students and Teachers (ITEST) program has funded researchers and educators to build an understanding of best practices, contexts, and processes contributing to K-12 students’ motivation and participation in Science, Technology, Engineering, and Mathematics (STEM) activities that lead to STEM career pathways. The outcomes from these projects have contributed significantly to the national body of knowledge about strategies, successes, models, and interventions that support and encourage youth to pursue STEM careers. While the individual projects discussed in this special issue vary by geographic location, institution, populations served, primary focus, and topic, they are unified by ITEST’s programmatic intent and goals. This issue offers research-based insights into the knowledge generated by a decade of ITEST-funded work in STEM career development. The articles describe a multitude of approaches to project design, evaluation, and empirical research. Collectively, they contribute to the development of frameworks for STEM education and workforce development that are increasingly relevant for educators, project designers, researchers, and policy makers. The ITEST program has enabled creativity, experimentation, and cultural responsiveness in STEM education and workforce development and broadened participation in STEM initiatives to Native American communities, underresourced urban communities, girls, and populations underrepresented in STEM fields. By approaching research and evaluation with flexibility and resourcefulness, the authors provide empirical evidence for the value of innovative approaches to STEM education that promote STEM interest and career-related outcomes and that build the foundational skills of the scientific and engineering workforce of the future. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: ITEST; Science education; STEM career development; STEM education; STEM engagement; Workforce innovation

DOCUMENT TYPE: Article

SOURCE: Scopus

Stevens, S.a , Andrade, R.a , Page, M.b

Motivating Young Native American Students to Pursue STEM Learning Through a Culturally Relevant Science Program

(2016) Journal of Science Education and Technology, 25 (6), pp. 947-960.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85002763715&doi=10.1007%2fs10956-016-9629-1&partnerID=40&md5=7506db4b54272473b966dee5affe6f2a

DOI: 10.1007/s10956-016-9629-1

AFFILIATIONS: Southwest Institute for Research on Women, University of Arizona, 925 N. Tyndall, Tucson, AZ, United States;

Evaluation Research and Development, University of Arizona, Tucson, AZ, United States

ABSTRACT: Data indicate that females and ethnic/race minority groups are underrepresented in the science and engineering workforce calling for innovative strategies to engage and retain them in science education and careers. This study reports on the development, delivery, and outcomes of a culturally driven science, technology, engineering, mathematics (STEM) program, iSTEM, aimed at increasing engagement in STEM learning among Native American 3rd–8th grade students. A culturally relevant theoretical framework, Funds of Knowledge, informs the iSTEM program, a program based on the contention that the synergistic effect of a hybrid program combining two strategic approaches (1) in-school mentoring and (2) out-of-school informal science education experiences would foster engagement and interest in STEM learning. Students are paired with one of three types of mentors: Native American community members, university students, and STEM professionals. The iSTEM program is theme based with all program activities specifically relevant to Native people living in southern Arizona. Student mentees and mentors complete interactive flash STEM activities at lunch hour and attend approximately six field trips per year. Data from the iSTEM program indicate that the program has been successful in engaging Native American students in iSTEM as well as increasing their interest in STEM and their science beliefs. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Funds of Knowledge; Informal science; K-12; Mentoring; Native American; STEM learning

DOCUMENT TYPE: Article

SOURCE: Scopus

Zervas, P.a , Tsourlidaki, E.b , Cao, Y.c , Sotiriou, S.b , Sampson, D.G.a d , Faltin, N.c

A study on the use of a metadata schema for characterizing school education STEM lessons plans by STEM teachers

(2016) Journal of Computing in Higher Education, 28 (3), pp. 389-405.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994358615&doi=10.1007%2fs12528-016-9113-1&partnerID=40&md5=fada7e42458112d4f6af6d887900c0d2

DOI: 10.1007/s12528-016-9113-1

AFFILIATIONS: Information Technologies Institute, Centre for Research and Technology Hellas, P.O. Box 60361, 6th km Charilaou-Thermi Rd, Thessaloniki, Greece;

Ellinogermaniki Agogi, Dimitriou Panagea Str., Pallini Attikis, Greece;

IMC Information Multimedia Communication AG, Scheer Tower, Uni-Campus Nord, Saarbrücken, Germany;

School of Education, Curtin University, Bentley Campus, Kent Street, Bentley, Perth, WA, Australia

ABSTRACT: Online labs (OLs) constitute digital educational tools which can have a significant role in supporting science, technology, engineering and mathematics (STEM) teachers in their daily teaching practice. Designing STEM lessons supported by specific OLs is a challenging task and thus, it is useful for STEM teachers to be able to share their lesson plans in a way that these can be effectively searched by others. The most common way to facilitate this process is (a) to characterize the lesson plans with appropriately selected educational metadata and (b) to build a web repository that collects the metadata records of the lesson plans (following a common metadata schema) and offers search and retrieval functionalities. In our previous work, a metadata schema that can be used for characterizing STEM lesson plans supported by OLs has been proposed. The scope of this paper is to complement the findings of our previous work and present the technical implementation of the proposed metadata schema via a web-based repository, namely the Go-Lab repository and a study on the real usage of the metadata schema’s elements through the analysis of the lesson plans’ metadata records that have been published to this repository by STEM teachers. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Inquiry-based learning; Lesson plan; Metadata schema; Online lab; School STEM education; Web-based repository

DOCUMENT TYPE: Article

SOURCE: Scopus

Kowalski, J.R.a , Hoops, G.C.b , Johnson, R.J.b

Implementation of a collaborative series of classroom-based undergraduate research experiences spanning chemical biology, biochemistry, and neurobiology

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https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994766831&doi=10.1187%2fcbe.16-02-0089&partnerID=40&md5=389f41872202cd00e28412ad2e3fd92a

DOI: 10.1187/cbe.16-02-0089

AFFILIATIONS: Department of Biological Sciences, Butler University, Indianapolis, IN, United States;

Department of Chemistry, Butler University, Indianapolis, IN, United States

ABSTRACT: Classroom undergraduate research experiences (CUREs) provide students access to the measurable benefits of undergraduate research experiences (UREs). Herein, we describe the implementation and assessment of a novel model for cohesive CUREs focused on central research themes involving faculty research collaboration across departments. Specifically, we implemented three collaborative CUREs spanning chemical biology, biochemistry, and neurobiology that incorporated faculty members’ research interests and revolved around the central theme of visualizing biological processes like Mycobacterium tuberculosis enzyme activity and neural signaling using fluorescent molecules. Each CURE laboratory involved multiple experimental phases and culminated in novel, open-ended, and reiterative student-driven research projects. Course assessments showed CURE participation increased students’ experimental design skills, attitudes and confidence about research, perceived understanding of the scientific process, and interest in science, technology, engineering, and mathematics disciplines. More than 75% of CURE students also engaged in independent scientific research projects, and faculty CURE contributors saw substantial increases in research productivity, including increased undergraduate student involvement and academic outputs. Our collaborative CUREs demonstrate the advantages of multicourse CUREs for achieving increased faculty research productivity and traditional CURE-associated student learning and attitude gains. Our collaborative CURE design represents a novel CURE model for ongoing laboratory reform that benefits both faculty and students. © 2016 J. R. Kowalski et al.

DOCUMENT TYPE: Article

SOURCE: Scopus

Peterman, K.a , Kermish-Allen, R.b , Knezek, G.c , Christensen, R.d , Tyler-Wood, T.c

Measuring Student Career Interest within the Context of Technology-Enhanced STEM Projects: A Cross-Project Comparison Study Based on the Career Interest Questionnaire

(2016) Journal of Science Education and Technology, 25 (6), pp. 833-845. Cited 1 time.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84961636950&doi=10.1007%2fs10956-016-9617-5&partnerID=40&md5=86b3f1821699474ff84cbdfa52d8b21f

DOI: 10.1007/s10956-016-9617-5

AFFILIATIONS: Karen Peterman Consulting, Co., 2706 Stuart Drive, Durham, NC, United States;

Maine Math and Science Alliance, 219 Capitol Street Suite 3, Augusta, ME, United States;

Department of Learning Technologies, University of North Texas, 3940 N. Elm, Denton, TX, United States;

Institute for the Integration of Technology into Teaching and Learning, University of North Texas, Denton, TX, United States

ABSTRACT: This article describes Energy for ME and Going Green! Middle Schoolers Out to Save the World, two Science, Technology, Engineering, and Mathematics (STEM) education programs with the common goal of improving students’ attitudes about scientific careers. The authors represent two project teams, each with funding from the National Science Foundation’s ITEST program. Using different approaches and technology, both projects challenged students to use electricity monitoring system data to create action plans for conserving energy in their homes and communities. The impact of each project on students’ career interests was assessed via a multi-method evaluation that included the Career Interest Questionnaire (CIQ), a measure that was validated within the context of ITEST projects and has since become one of the instruments used most commonly across the ITEST community. This article explores the extent to which the CIQ can be used to document the effects of technology-enhanced STEM educational experiences on students’ career attitudes and intentions in different environments. The results indicate that the CIQ, and the Intent subscale in particular, served as significant predictors of students’ self-reported STEM career aspirations across project context. Results from each project also demonstrated content gains by students and demonstrated the impact of project participation and gender on student outcomes. The authors conclude that the CIQ is a useful tool for providing empirical evidence to document the impact of technology-enhanced science education programs, particularly with regard to Intent to purse a STEM career. The need for additional cross-project comparison studies is also discussed. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Career attitudes; Energy; Outcomes

DOCUMENT TYPE: Article

SOURCE: Scopus

Gierl, M.J., Lai, H.

A Process for Reviewing and Evaluating Generated Test Items

(2016) Educational Measurement: Issues and Practice, 35 (4), pp. 6-20.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006381797&doi=10.1111%2femip.12129&partnerID=40&md5=0365bb5a31ccb35843faea7c771767fa

DOI: 10.1111/emip.12129

AFFILIATIONS: University of Alberta, Canada

ABSTRACT: Testing organization needs large numbers of high-quality items due to the proliferation of alternative test administration methods and modern test designs. But the current demand for items far exceeds the supply. Test items, as they are currently written, evoke a process that is both time-consuming and expensive because each item is written, edited, and reviewed by a subject-matter expert. One promising approach that may address this challenge is with automatic item generation. Automatic item generation combines cognitive and psychometric modeling practices to guide the production of items that are generated with the aid of computer technology. The purpose of this study is to describe and illustrate a process that can be used to review and evaluate the quality of the generated item by focusing on the content and logic specified within the item generation procedure. We illustrate our process using an item development example from mathematics drawn from the Common Core State Standards and from surgical education drawn from the health sciences domain. © 2016 by the National Council on Measurement in Education

AUTHOR KEYWORDS: automatic item generation; item development; technology and assessment

DOCUMENT TYPE: Article

SOURCE: Scopus

Moreno, N.P., Tharp, B.Z., Vogt, G., Newell, A.D., Burnett, C.A.

Preparing Students for Middle School Through After-School STEM Activities

(2016) Journal of Science Education and Technology, 25 (6), pp. 889-897.

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DOI: 10.1007/s10956-016-9643-3

AFFILIATIONS: Baylor College of Medicine, Houston, TX, United States

ABSTRACT: The middle school years are a crucial time for cultivating students’ interest in and preparedness for future STEM careers. However, not all middle school children are provided opportunities to engage, learn and achieve in STEM subject areas. Engineering, in particular, is neglected in these grades because it usually is not part of science or mathematics curricula. This study investigates the effectiveness of an engineering-integrated STEM curriculum designed for use in an after-school environment. The inquiry-based activities comprising the unit, Think Like an Astronaut, were intended to introduce students to STEM careers—specifically engineering and aerospace engineering—and enhance their skills and knowledge applicable related to typical middle school science objectives. Results of a field test with a diverse population of 5th grade students in nine schools revealed that Think Like an Astronaut lessons are appropriate for an after-school environment, and may potentially help increase students’ STEM-related content knowledge and skills. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: After school; Engineering education; Middle school preparedness; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Bass, K.M.a , Hu Dahl, I.b , Panahandeh, S.a

Designing the Game: How a Project-Based Media Production Program Approaches STEAM Career Readiness for Underrepresented Young Adults

(2016) Journal of Science Education and Technology, 25 (6), pp. 1009-1024.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84978757604&doi=10.1007%2fs10956-016-9631-7&partnerID=40&md5=80d800a62f6a10c754e1184e88aa7d8a

DOI: 10.1007/s10956-016-9631-7

AFFILIATIONS: Rockman et al, 595 Market Street, Suite 2570, San Francisco, CA, United States;

Bay Area Video Coalition, 2727 Mariposa Street, 2nd Floor, San Francisco, CA, United States

ABSTRACT: Numerous studies have indicated a need for a diverse workforce that is more highly educated in STEM and ICT fields, and one that is capable of responding creatively to demands for continual innovation. This paper, in response, chronicles the implementation of the Digital Pathways (DP) program, a two-time ITEST recipient and an ongoing initiative of the Bay Area Video Coalition. DP has provided low-income, underrepresented minority young people with 180 contact hours of activities in digital media production to prepare them to pursue higher education and technology careers. A design-based research approach synthesizes staff interviews with student observations, interviews and artifacts to identify a set of generalizable best practices or design principles for empowering young people to move from being consumers of digital media to producers. These principles are illustrated with a case study of the 3D Animation and Gaming track from the second ITEST grant. Researchers argue for the importance of attending to the noncognitive elements of learning and illustrate ways in which instructors encouraged creative expression, personal agency, and collaboration through long-term projects. They also identify strategies for sustaining young people’s participation through the establishment of a supportive community environment. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Digital media production; Gaming; Science Technology Engineering Arts and Mathematics (STEAM); Twenty-first-century skills; Workforce development

DOCUMENT TYPE: Article

SOURCE: Scopus

Brancaccio-Taras, L.a , Pape-Lindstrom, P.b , Peteroy-Kelly, M.c , Aguirre, K.d , Awong-Taylor, J.e , Balser, T.f , Cahill, M.J.g , Frey, R.F.g , Jack, T.h , Kelrick, M.i , Marley, K.j , Miller, K.G.k , Osgood, M.l , Romano, S.m , Uzman, J.A.n , Zhao, J.g

The PULSE Vision & Change Rubrics,version 1.0: A valid and equitable tool to measure transformation of life sciences departments at all institution types

(2016) CBE Life Sciences Education, 15 (4), art. no. ar60, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84996520844&doi=10.1187%2fcbe.15-12-0260&partnerID=40&md5=c2027fbf0da81cf9ed1f49303c639413

DOI: 10.1187/cbe.15-12-0260

AFFILIATIONS: Department of Biological Sciences, Kingsborough Community College–CUNY, Brooklyn, NY, United States;

Life Sciences Department, Everett Community College, Everett, WA, United States;

Department of Biology, Pace University, New York, NY, United States;

Department of Biology, Coastal Carolina University, Conway, SC, United States;

Department of Biology, Georgia Gwinnett College, Lawrenceville, GA, United States;

Curtin University, Faculty of Science and Engineering, Perth, WA, Australia;

Center for Integrative Research on Cognition,Learning,and Education (CIRCLE), Washington University in St. Louis, St. Louis, MO, United States;

Department of Biological Sciences, Dartmouth College, Hanover, NH, United States;

Department of Biology, Truman State University, Kirksville, MO, United States;

Office of the Vice President for Academic Affairs, Doane College, Crete, NE, United States;

Department of Biology, Washington University in St. Louis, St. Louis, MO, United States;

Department of Biochemistry and Molecular Biology, University of New Mexico, Albuquerque, NM, United States;

College of Science and Mathematics, University of the Virgin Islands, St. Thomas, MN, United States;

College of Sciences and Technology, University of Houston– Downtown, Houston, TX, United States

ABSTRACT: The PULSE Vision & Change Rubrics,version 1.0,assess life sciences departments’ progress toward implementation of the principles of the Vision and Change report. This paper reports on the development of the rubrics,their validation,and their reliability in measuring departmental change aligned with the Vision and Change recommendations. The rubrics assess 66 different criteria across five areas: Curriculum Alignment,Assessment,Faculty Practice/Faculty Support,Infrastructure,and Climate for Change. The results from this work demonstrate the rubrics can be used to evaluate departmental transformation equitably across institution types and represent baseline data about the adoption of the Vision and Change recommendations by life sciences programs across the United States. While all institution types have made progress,liberal arts institutions are farther along in implementing these recommendations. Generally,institutions earned the highest scores on the Curriculum Alignment rubric and the lowest scores on the Assessment rubric. The results of this study clearly indicate that the Vision & Change Rubrics,version 1.0,are valid and equitable and can track long-term progress of the transformation of life sciences departments. In addition,four of the five rubrics have broad applicability and can be used to evaluate departmental transformation by other science,technology,engineering,and mathematics disciplines. © 2016 L. Brancaccio-Taras et al.

DOCUMENT TYPE: Article

SOURCE: Scopus

Liu, Y.-N.a , Chen, H.-Y.a , Gilani, S.M.M.b

A cloud-assisted architecture for content distribution in mobile peer to peer networks

(2016) Journal of Digital Information Management, 14 (6), pp. 403-412.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010972068&partnerID=40&md5=478dd69ec164325e2daff594a03ec7d0

AFFILIATIONS: School of Communication and Information Engineering, Chongqing University of Posts and Telecommunications, Chongqing, China;

University Institute of Information Technology, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Punjab, Pakistan

ABSTRACT: Content distribution is a key technology to achieve data sharing among mobile terminals in Mobile Peer to Peer (MP2P) networks. Nevertheless, in the dynamic/mobile environment, the poor computing ability and storage capability of a single node make it difficult to share the content among nodes. In order to enhance the capability of the mobile terminals and improve the efficiency of content distribution, a cloud-assisted architecture to offload the heavy computation load from the mobile nodes to the cloud was put forward. Furthermore, a Multi-Tree Structure of Internal Node Disjoint (MTSIND) data transfer topology was proposed, in which their internal nodes are disjoint, thus each node can take part in the content delivery tasks. Finally, an exclusive-OR (XOR) network coding method based on vertex coloring problem was established to reduce the number of transmissions and power consumption. Simulation and numerical results were provided to support the analyses and results. Results show that the content distribution mechanism can reduce the total number of the data packets and the energy consumption. The study proves that the research of content distribution mechanism on MP2P has a great significance on reducing the number of data transmissions, lowering the power consumption of terminals and increasing the resource utilization of mobile nodes.

AUTHOR KEYWORDS: Cloud-assisted architecture; Content distribution; Mobile peer to peer network this work is partially supported by nsfc China (no. 61501075); Network coding; Scientific and technological research program of chongqing municipal education commission

DOCUMENT TYPE: Article

SOURCE: Scopus

Selcen Guzey, S.a , Harwell, M.b , Moreno, M.b , Peralta, Y.b , Moore, T.J.c

The Impact of Design-Based STEM Integration Curricula on Student Achievement in Engineering, Science, and Mathematics

(2016) Journal of Science Education and Technology, pp. 1-16. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84997646360&doi=10.1007%2fs10956-016-9673-x&partnerID=40&md5=38f28eb52b8f1630a5e962e758040873

DOI: 10.1007/s10956-016-9673-x

AFFILIATIONS: Department of Curriculum and Instruction and Department of Biological Sciences, Purdue University, West Lafayette, IN, United States;

Department of Educational Psychology, University of Minnesota, Minneapolis, MN, United States;

School of Engineering Education, Purdue University, West Lafayette, IN, United States

ABSTRACT: The new science education reform documents call for integration of engineering into K-12 science classes. Engineering design and practices are new to most science teachers, meaning that implementing effective engineering instruction is likely to be challenging. This quasi-experimental study explored the influence of teacher-developed, engineering design-based science curriculum units on learning and achievement among grade 4–8 students of different races, gender, special education status, and limited English proficiency (LEP) status. Treatment and control students (n = 4450) completed pretest and posttest assessments in science, engineering, and mathematics as well as a state-mandated mathematics test. Single-level regression results for science outcomes favored the treatment for one science assessment (physical science, heat transfer), but multilevel analyses showed no significant treatment effect. We also found that engineering integration had different effects across race and gender and that teacher gender can reduce or exacerbate the gap in engineering achievement for student subgroups depending on the outcome. Other teacher factors such as the quality of engineering-focused science units and engineering instruction were predictive of student achievement in engineering. Implications for practice are discussed. © 2016 Springer Science+Business Media New York

AUTHOR KEYWORDS: Engineering curriculum; Engineering integration; STEM; Student learning

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Kalloo, V.a , Mohan, P.a , Kinshukb

An investigative process for enhancing the design of a mathematics learning game

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7756937, pp. 117-119.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006856486&doi=10.1109%2fICALT.2016.20&partnerID=40&md5=5f2145f728c2bddc6d2f662554b1a365

DOI: 10.1109/ICALT.2016.20

AFFILIATIONS: Department of Computing and Information Technology, University of West Indies, Trinidad and Tobago;

School of Computing and Information Technology, Athabasca University, Canada

ABSTRACT: In this paper, the authors present an investigative process which can be used to enhance the design of mathematics learning games. Several techniques such as mathematics pedagogy and game design lenses [12] were studied in the development of this investigative process. Game design lenses are tools developed for examining game designs. The game design lenses were analyzed and mapped to several mathematics-specific teaching and learning theories. The authors present a mapping of the lenses to the learning theories and the resultant process investigates and incorporates suitable theories into a mathematics game design. This paper presents a process for incorporating necessary teaching and learning theories into mathematics learning games. © 2016 IEEE.

AUTHOR KEYWORDS: Educational game design; Game design; Game design lenses; Learning games; Mathematics learning games; Mathematics pedagogy; Serious games

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Zintgraff, C.a , Fuller, E.b

Why power and careers with mathematics: How middle school students responded in a virtual world

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7757045, pp. 538-539.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006886594&doi=10.1109%2fICALT.2016.144&partnerID=40&md5=1ed7aaf187b844b2861c2d308eb4911a

DOI: 10.1109/ICALT.2016.144

AFFILIATIONS: Department of Learning Technologies, University of North Texas, Denton, TX, United States;

Department of Education Policy Studies, Penn State University, University Park, PA, United States

ABSTRACT: Middle school students participated in WhyPower, a virtual power plant activity in Whyville, a learning-based virtual world for teens and tweens. Pre- And post-activity surveys included measurement of interest in careers involving mathematics. Statistical analysis revealed that students with strong positive views of mathematics-related careers were unaffected, but other students moved strongly toward interest in careers involving mathematics. Citing related literature, the authors speculate that student self-efficacy may have increased as students virtually experienced mathematics-related careers. © 2016 IEEE.

AUTHOR KEYWORDS: Careers; Mathematics; Self-efficacy; Virtual worlds; Whypower; Whyville

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Moore, C.P., Watterson, C.A., Eldgridge, J.A.

Practical laboratory classes to improve engagement and achievement amongst engineering students taking first-year mathematics

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757667, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006750224&doi=10.1109%2fFIE.2016.7757667&partnerID=40&md5=1cdc12bc151202779911faf64249c95c

DOI: 10.1109/FIE.2016.7757667

AFFILIATIONS: School of Engineering and Computer Science, Victoria University of Wellington, Wellington, New Zealand

ABSTRACT: We describe the planning, delivery, and assessment of laboratory classes offered as part of two first-year mathematics courses for engineering students. The laboratory classes, which use practical examples inspired by second-, third- and fourth-year engineering courses, were designed to illustrate the relevance of mathematics to engineering. Once these classes were introduced the percentage of engaged students increased by up to a third, leading to similar improvements in pass rates and median marks. © 2016 IEEE.

AUTHOR KEYWORDS: 21st century learning; Engineering; Mathematics; Problem-based learning

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Dasgupta, A., Purzer, S.

No patterns in pattern recognition: A systematic literature review

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757676, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006788281&doi=10.1109%2fFIE.2016.7757676&partnerID=40&md5=61698eae93c79072a676782c3f935a7e

DOI: 10.1109/FIE.2016.7757676

AFFILIATIONS: School of Engineering Education, Purdue University, West Lafayette, IN, United States

ABSTRACT: Pattern recognition is one of the fundamental competencies associated with computational thinking and STEM education. Although much has been written to define computational thinking (CT), we argue that CT is a multi-faceted construct and specific aspects of CT (such as pattern recognition) should be examined. The purpose of this study is to conduct a systematic review of literature on pattern recognition to define pattern recognition as an aspect of computational thinking. The synthesis included the Engineering Village database (Compendex and INSPEC). We searched peer reviewed articles and the keywords, pattern recognition, pattern generalization and education. The initial search resulted in 208 articles. The screening of abstracts more closely resulted in 17 relevant articles, which were then read in detail by two researchers. The review of this pool resulted in two relevant articles, one with a focus on mathematics education and the other one in the context of medical education. Surprisingly there were no articles that examined pattern recognition as part of engineering or computer education. Further research examining specific aspects of CT is necessary. © 2016 IEEE.

AUTHOR KEYWORDS: Computational thinking; Computer education; Computing; Pattern generalization; Pattern recognition; STEM

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Bojic, I.a , Podobnik, V.c , Arratia, J.F.c , Grgic, M.b

Supporting economically disadvantaged students from Nicaragua in STEM-C fields

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757526, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006716776&doi=10.1109%2fFIE.2016.7757526&partnerID=40&md5=fe8a1a8777d83cd717ef16f3311230f5

DOI: 10.1109/FIE.2016.7757526

AFFILIATIONS: SENSEable City Laboratory, Singapore-MIT Alliance for Research and Technology, 1 Create Way, Singapore, Singapore;

Faculty of Electrical Engineering and Computing, University of Zagreb, Unska 3, Zagreb, Croatia;

Stud. Research Development Center, Ana G. Mendez University System, 1399 Ave. Ana G Mendez, San Juan, Puerto Rico

ABSTRACT: Even students who are provided with currently best available education in Science, Technology, Engineering, Mathematics and Computer Science (STEM-C) fields are having problems coping with living in the modern world where technological advancements happen on a daily basis, let alone students coming from economically disadvantaged backgrounds. In a world where institutions offering formal education have to collaborate with individuals and groups of people interested in providing informal education, it is of a vital importance to set up good examples and share them with communities that are less experienced. In this paper we present how Student Research Development Center's (SRDC) best practices of establishing a pre-college pipeline for young economically disadvantage minority students, who are interested in STEM-C fields, from Puerto Rico are being transferred to Universidad Catolica de Nicaragua (UNICA). The goal of the paper is to show how we developed a partnership between Puerto Rico and Nicaragua, and used lessons learned in Puerto Rico to involve undergraduate and pre-college students from Nicaragua in research program using project based learning in STEM-C fields. © 2016 IEEE.

AUTHOR KEYWORDS: Informal and formal education; Project based learning; Puerto Rico

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Bigotte, M.E.a , Gomes, A.a , Branco, J.R.a , Pessoa, T.b

The influence of educational learning paths in academic success of mathematics in engineering undergraduate

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757453, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006783190&doi=10.1109%2fFIE.2016.7757453&partnerID=40&md5=7c2b5b2da5ad68ebc67823e448a24b2e

DOI: 10.1109/FIE.2016.7757453

AFFILIATIONS: Engineering Institute of Polytechnic Institute of Coimbra, Center for Informatics and Systems, University of Coimbra, Coimbra, Portugal;

Faculty of Psycholgy and Educational Sciences, University of Coimbra, Coimbra, Portugal

ABSTRACT: Issues related to the failure of mathematics in the teaching of engineering and the negative impact that these difficulties have in various courses in engineering degrees is a problem to which we have devoted our attention and investigation. Most students when entering higher education have insufficient preparation in mathematics. It is further aggravated because of the different areas of knowledge from their background when entering degrees in Engineering. The Mathematics in Engineering Support Center (CeAMatE) is a space intended to monitor students who attend the course of 'Differential and Integral Calculus'. It allows the construction of an academic course that promotes the development of students' independent study skills, with the joint responsibility of building their own educational paths. It also facilitates the construction of learning and acquisition of new knowledge through the availability of various activities and resources aimed at overcoming students' difficulties. It also incorporates an e-learning component, adapting to the learning styles and cognitive levels of students. The understanding of the educational pathways made by students who attended CeAMatE and the corresponding academic achievement in 'Differential and Integral Calculus' course is a goal of this study. This analysis will permit a better development of a set of suitable mathematical strategies/activities. © 2016 IEEE.

AUTHOR KEYWORDS: Blended learning; Engineering; Learning paths; Mathematics

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Ureel, L.C., II, Wallace, C.

Discrete mathematics for computing students: A programming oriented approach with alloy

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757641, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006821433&doi=10.1109%2fFIE.2016.7757641&partnerID=40&md5=8441876c7647c187b80b56ff5d266157

DOI: 10.1109/FIE.2016.7757641

AFFILIATIONS: Department of Computer Science, Michigan Technological University, Houghton, MI, United States

ABSTRACT: Students in computing disciplines need a strong basis in the fundamentals of discrete mathematics. Traditional "offline" approaches to teaching this material provide limited opportunities for the kind of interactive learning that students experience in their programming assignments. We have been using the Alloy language and analysis tool to teach concepts in discrete structures and logic in an exploratory, programming-intensive way. We report on our efforts to build scaffolded Alloy exercises for newcomers to discrete mathematics, and we report on some initial findings based on our experiences with students. © 2016 IEEE.

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Duffy, G.a , Sorby, S.b , Nozaki, S.b , Bowe, B.c

Exploring the role of spatial cognition in problem solving

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757593, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006757006&doi=10.1109%2fFIE.2016.7757593&partnerID=40&md5=f56ad96ba0f44254ca5842f94ab05c05

DOI: 10.1109/FIE.2016.7757593

AFFILIATIONS: School of Electrical and Electronic Engineering, Dublin Institute of Technology, Dublin, Ireland;

Dept of Engineering Education, Ohio State University, Columbus, OH, United States;

College of Engineering and Built Environment, Dublin Institute of Technology, Dublin, Ireland

ABSTRACT: While spatial aptitude is acknowledged as a key cognitive ability that accompanies success in STEM education, less is reported about the qualitative differences between weak and strong visualisers in how they approach and engage with assessments in STEM education. In this paper, we study one particular aspect of the STEM curriculum-solving convergent 'word' problems in mathematics-in an attempt to discern quantitative and qualitative differences between the approaches weak and strong visualisers adopt when solving these problems. The paper is a work-in-progress that started with a search for suitable convergent mathematics problems which were then presented to a small sample of engineering students using a think aloud protocol. Participants were asked to think aloud while they solved the problems and to write their answers using a LiveScribe pen to concurrently record spoken and written responses. They also completed a spatial skills test. The magnitude and significance of the correlation between the spatial and mathematics tests scores were measured to be r =.79, p <.01. © 2016 IEEE.

AUTHOR KEYWORDS: Problem solving; Spatial skills

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Golubski, C.

Using inquiry-based learning in engineering statistics courses

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757451, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006815357&doi=10.1109%2fFIE.2016.7757451&partnerID=40&md5=88cf97dac3dee416cd4473e22221758d

DOI: 10.1109/FIE.2016.7757451

AFFILIATIONS: Department of STEM Education, University of Texas at Austin, Austin, TX, United States

ABSTRACT: Many engineering students struggle with a first course in statistics. One of the reasons for this is that statistics differs from 'traditional' mathematics curriculum, such as calculus and differential equations. Merely giving students problem sets does not teach them to think in a particular fashion, as statistics problems require the assimilation of more varied information than using formulas or even applying those formulas to situational (story) problems to solve for a particular variable or variables. Data rarely conforms to contrived values, so the student's ability to critically think and make decisions is of paramount importance. Since statistics is different from a traditional mathematics discipline, we feel it is necessary to differentiate instruction from a traditional mathematics class. Because statistics and data science requires considerable decision-making processes and analytical ability, we feel that elements of inquiry-based learning will be beneficial to students. These inquiry-based lessons will be provided in the form of POGIL, or Process-Oriented Guided Inquiry Learning, activities designed to lead small groups of students through specific material within a specific subject domain. © 2016 IEEE.

AUTHOR KEYWORDS: Engineering education; Inquiry-based learning; POGIL; Statistics education

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Yaprak, E.a , Crosby, K.a , Pierrakos, O.a , Ilumoka, A.a , Weatherton, Y.P.a , Douglas, E.b , Moore, J.b

National Science Foundation programs that support engineering education research

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757339, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006836465&doi=10.1109%2fFIE.2016.7757339&partnerID=40&md5=8a3fbd457dcf0b00bad85f0491f95dbf

DOI: 10.1109/FIE.2016.7757339

AFFILIATIONS: Division Undergraduate Education, Direct. of Education and Human Resources, National Science Foundation, Arlington, VA, United States;

Division of Engineering Education and Centers, Direct. of Engineering, National Science Foundation, Arlington, VA, United States

ABSTRACT: The goal of this session is to increase the participants' knowledge of current funding opportunities at the National Science Foundation (NSF) to support projects with potential significant impacts on science, technology, engineering, and mathematics (STEM) education. In particular, the discussion will focus on new and current funding opportunities in the Division of Undergraduate Education (DUE) in the Directorate of Education and Human Resources (EHR) and the Division of Engineering Education & Centers (EEC) in the Directorate of Engineering. During the session, we will provide examples of project activities that support STEM education research opportunities. The session will use a highly interactive format (i.e., team-based activities and discussion) to engage the participants, to clarify misconceptions, and to potentially initiate and share new ideas pertinent to engineering education research and innovations in classroom implementations. This session facilitates idea sharing and interaction amongst peers. © 2016 IEEE.

AUTHOR KEYWORDS: Curriculum development; Engineering education; Faculty development; Funding opportunities; National Science Foundation; Student learning; Student learning environments

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

De Santana, S.J.a , Paiva, R.b , Bittencourt, I.I.a , Ospina, P.E.c , De Amorim Silva, R.a , Isotani, S.d

Evaluating the impact of mars and venus effect on the use of an adaptive learning technology for Portuguese and mathematics

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7756914, pp. 31-35.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006922960&doi=10.1109%2fICALT.2016.58&partnerID=40&md5=0ed062a1a3b05289210681b55657354f

DOI: 10.1109/ICALT.2016.58

AFFILIATIONS: Computing Institute - IC, Federal University of Alagoas - UFAL, Maceio, Brazil;

Computing and Systems Department - DSC, Federal University of Campina Grande - UFCG, Campina Grande, Brazil;

Center of Exact Sciences and Nature - CCEN, Federal University of Pernambuco - UFPE, Recife, Brazil;

Mathematics and Computer Science Institute - ICMC, University of São Paulo - USP, Sao Paulo, Brazil

ABSTRACT: Some recent studies discussed the pros and cons of gender difference in the use of intelligent educational technologies. According to these studies, there is a difference in behavior, attitude, learning and emotion. However, most of the studies were conducted for Mathematics and in a well developed ecological setting. In this work, we investigated the Mars and Venus Effect, by measuring together different variables, such as learning performance (in Portuguese and Mathematics), age, location area, and learning technology. The study was a random pre/posttest control group experimental design, on which 191 students from public schools in Brazil participated. The experimental group used an adaptive learning technology (called MeuTutor) for nine months, while the control group did not use any educational technology during the study. The most relevant results are: i) the use of the adaptive learning technology improves student's performance in Mathematics and Portuguese for both male and female students, ii) the improvement of male student's performance is more significant, against female students, iii) when we focus on technology, male students had better performance in mathematics, but no significant difference in Portuguese. © 2016 IEEE.

AUTHOR KEYWORDS: Adaptive Learning Technology; Controlled Experiment; Gender Difference; Mars and Venus Effect

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Hsiao, I.Y.T.a , Yang, S.J.H.a , Wei, Y.-H.a , Chang, T.-L.b , Lan, Y.-J.c

Creating a 3D game-based learning system in a virtual world for low-achieving students in mathematics

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7757039, pp. 518-519.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006857934&doi=10.1109%2fICALT.2016.37&partnerID=40&md5=63dd0816adf901aa0730d45b1033b926

DOI: 10.1109/ICALT.2016.37

AFFILIATIONS: Department of Computer Science and Information Engineering, National Central University, Taoyuan, Taiwan;

Chian Long Elementary School, Taoyuan, Taiwan;

Department of Applied Chinese Language and Culture, National Taiwan Normal University, Taipei, Taiwan

ABSTRACT: Elementary school students' mathematical ability plays an important role in the development of their future, but the proportion of low-achieving elementary students in mathematics in Taiwan is high due to their aversion to mathematics. The aim of this study is to establish a learning system to help low-achieving students' learning in mathematics. A 3D game-based learning system was developed in this study to achieve the aim and the students' learning outcomes were measured by the pre, post-test and their learning logs in the system. The participants were 6 elementary school lowachieving students studying in Northern Taiwan. The results showed that the system improved their learning outcomes. The design of the system can also be a reference for developing future virtual learning systems for mathematics. © 2016 IEEE.

AUTHOR KEYWORDS: Digital gamebased learning; Mathematic learning; Second life

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Fang, N., Lawanto, O., Goodridge, W., Villanueva, I.

Research experiences for undergraduates (REU) on self-regulated learning in engineering education

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757480, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006817294&doi=10.1109%2fFIE.2016.7757480&partnerID=40&md5=8085736dcf6caded47063fe8e4aa1e67

DOI: 10.1109/FIE.2016.7757480

AFFILIATIONS: Department of Engineering Education, Utah State University, Logan, UT, United States

ABSTRACT: Undergraduate research is one of the best practices to improve student learning and has a positive lasting impact on students' career choices and success. Extensive literature review shows that the vast majority of undergraduate research programs focus on Science, Technology, Engineering, and Mathematics (STEM) disciplinary research. This work-in-progress paper presents a new Research Experiences for Undergraduates (REU) Site program that focuses on STEM education research rather than STEM disciplinary research. This work-in-progress paper describes the overall framework of our REU Site program, student recruitment and selection in our most recent Summer 2015 program, and four REU research projects that share a common intellectual focus on self-regulated learning in engineering education. Representative comments from undergraduate student participants are provided to demonstrate the positive impact of this REU Site program. © 2016 IEEE.

AUTHOR KEYWORDS: Engineering education; Research experiences for undergraduates (REU); Self-regulated learning

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Spanias, A.a , Banavar, M.K.c , Braun, H.a , Spanias, P.b , Zhang, Y.d

Development of course modules for multidisciplinary STEM education

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757416, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006802474&doi=10.1109%2fFIE.2016.7757416&partnerID=40&md5=eed69e39ef8a8c2069bb956889572954

DOI: 10.1109/FIE.2016.7757416

AFFILIATIONS: School of ECEE, Clarkson University, United States;

MLFTC, ASU, United States;

Dept. of ECE, Clarkson University, United States;

Dept. et, Prairie View A and M University, United States

ABSTRACT: Traditional STEM education models in electrical engineering and computer science rely on structured classes, laboratories, and textbooks to transfer key concepts. Even though this process meets most of the ABET objectives, it does not respond well to current workforce needs that require widely accessible programs that will provide a large pool of graduates with STEM backgrounds, analytical and programming skills, critical thinking, and leadership abilities. In this work in progress paper, we describe our efforts to motivate students to pursue studies in STEM areas. We accomplish this by creating and disseminating modules that demonstrate how math and engineering theory enable modern applications such as those embedded in wireless devices. © 2016 IEEE.

AUTHOR KEYWORDS: Digital Signal Processing; Mobile learning; Online learning; STEM Education

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Tolbert, D., Lehman, R., Liu, G., Sadler, B., Cardella, M.

Knowledge transfer: Does more experience yield improved design quality?

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757349, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006827275&doi=10.1109%2fFIE.2016.7757349&partnerID=40&md5=c36aad5259f065ce163c675c9429cd84

DOI: 10.1109/FIE.2016.7757349

AFFILIATIONS: School of Engineering Education, Purdue University, West Lafayette, IN, United States

ABSTRACT: Engineers must be able to transfer knowledge from previous experiences in order to solve complex engineering tasks. Transfer of knowledge is described as 'the learning process involved when a person learns to use previously acquired knowledge, skills, competence, or expertise in a new situation' Therefore, we sought to explore how previous engineering, design, and mathematics experiences impact the quality of a design solution. In this study, 23 first-year engineering students, with diverse mathematics and design experiences, participated in research study. In this study, each student completed a pre-study survey, designed a playground for a fictitious neighborhood while thinking aloud, and completed an interview immediately after completing the playground task. They were asked to reflect on previous mathematics and design experiences and asked to make comparisons between those experiences and the design study they had just completed. The design session and the interview were recorded and the design artifacts were collected. Using Hailikari's model, the research team investigated the how knowledge transfer may impact design solution quality. The findings of the research have implications for approaches educators can use to help students apply knowledge from previous experiences and design high quality solutions. © 2016 IEEE.

AUTHOR KEYWORDS: Design; Engineering; First-Year Engineering; Mathematics

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Pilotte, M.a , Bairaktarova, D.b

Autism spectrum disorder and engineering education-needs and considerations

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757566, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006789313&doi=10.1109%2fFIE.2016.7757566&partnerID=40&md5=5a5565ad9504593b8a152ca1478474c7

DOI: 10.1109/FIE.2016.7757566

AFFILIATIONS: School of Engineering Education, Purdue University, West Lafayette, IN, United States;

Department of Engineering Education, Virginia Tech, Blacksburg, VA, United States

ABSTRACT: Universities are experiencing an increase in enrollment of high-functioning students with autism spectrum disorder (ASD). Even though many students with ASD do not attend college, it is reported that students with this diagnosis who do, often come from well to do families, and select STEM (Science, Technology, Engineering, Mathematics) education areas at rates above both the general population, and other differently-abled groups. While students classified with this diagnosis may hail from privileged educational exposures and demonstrate higher cognitive abilities, they often lack the ability to empathize and experience difficulty to socially connect with others. This includes an inability to decode informal social cues, which can impact the ability to communicate ideas during classroom situations. Concurrent to this notable shift in STEM student demographics, the landscape of engineering education is also changing. Greater emphasis is placed on providing an engaging and interactive student learning environment, bolstered by research demonstrating improved learning outcomes and higher retention rates. This work in process is the development of an emergent literature review, looking for the intersection between this student diagnosis, and the impact on the engineering education classroom and related stakeholders. Our work is an important first step in informing and guiding faculty and staff engagement on this unique and growing student population, especially in light of a national focus on STEM education, and dynamic changes in engineering education. © 2016 IEEE.

AUTHOR KEYWORDS: Autism spectrum disorder; Engineering classroom; Engineering education; Inclusive instruction; Practice

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Xie, Y., Qian, K., He, J.

Multi-dimensional and customizable open-source labware for promoting big data analytical skills in STEM education

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757700, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006729144&doi=10.1109%2fFIE.2016.7757700&partnerID=40&md5=4d09aff81bec0faa78e28018c2933749

DOI: 10.1109/FIE.2016.7757700

AFFILIATIONS: Department of Computer Science, Kennesaw State University, Kennesaw, GA, United States

ABSTRACT: In order to remove resource barriers and smooth the learning curve for education on big data analytics in STEM disciplines, we develop an portable open source labware that is called STEM-BD for promoting education on big data analytics. STEM-BD integrates the following four critical components, big data platform, big data sets, data analytics algorithms and hands-on lab exercises in a multi-dimensional and customizable way. In this paper, we provide a detailed description of the design goal of STEM-BD, its prototype, preliminary evaluation results, and future development. © 2016 IEEE.

AUTHOR KEYWORDS: Big data; Component; Labware; STEM education

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Hasbun, T., Araya, A., Villalon, J.

Extracurricular activities as dropout prediction factors in higher education using decision trees

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7756969, pp. 242-244.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006869767&doi=10.1109%2fICALT.2016.66&partnerID=40&md5=a5ad76b25276f06599297695cae0c713

DOI: 10.1109/ICALT.2016.66

AFFILIATIONS: School of Engineering and Science, Adolfo Ibáñez University, Santiago, Chile

ABSTRACT: Educational Data Mining can help predict dropout prone students and the factors institutions should observe in trying to avoid an important social problem in modern societies. However, most current predicting models use academic credit worth information from the curricula, ignoring extracurricular activities, while there is evidence from other research fields that some activities like sports can be related to academic performance. This paper studies the importance of extracurricular activities to predict dropout in students from two Bachelor of Science degrees (Engineering and Business). Data from 4.840 students was collected and two models, one including all data and another removing credits worth courses were trained and validated, showing that extracurricular activities are excellent dropout predictors. © 2016 IEEE.

AUTHOR KEYWORDS: Decision trees; Educational data mining

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Li, C.a , Said, H.a , Michael, R.a , Johnson, M.b , Meyer, H.b

Competency based IT experienes

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757572, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006784410&doi=10.1109%2fFIE.2016.7757572&partnerID=40&md5=309b7d584ce467b4170c7aa79f22f386

DOI: 10.1109/FIE.2016.7757572

AFFILIATIONS: School of Information Technology, University of Cincinnati, Cincinnati, United States;

School of Education, University of Cincinnati, Cincinnati, United States

ABSTRACT: This paper introduces an ongoing National Science Foundation funded project that prepares high school students for college readiness and fosters student interests in careers in Information Technology. The project targets a mixed student population from urban, low-income settings. Based on the project's first-year results, the paper proposes significant changes that will be implemented in the project's second year. These changes include a competency-based education curriculum in which students' IT knowledge and skills can be assessed in a way that three college course credits can be awarded to students who are still in high schools, a 12-hour graduate certificate program that prepares both in-and pre-service teachers to teach college IT courses for University of Cincinnati at their high schools through an Ohio College Credit Plus program, and a more concentrated research in computational thinking, which has been brought up for national attention and recognized as one of the essential competencies among Science, Technology, Engineering, and Mathematics disciplines. © 2016 IEEE.

AUTHOR KEYWORDS: Competency-based education; Computational thinking; Curriculum development; Information technology; K-12 STEM education; Teacher preparation

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Stansell, A., Tyler-Wod, T.

Digital fabrication for STEM projects: A middle school example

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7757029, pp. 483-485.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006940786&doi=10.1109%2fICALT.2016.44&partnerID=40&md5=92695b3c171527365d1509853de4461b

DOI: 10.1109/ICALT.2016.44

AFFILIATIONS: University of North Texas, Denton, United States

ABSTRACT: This paper explains the background of digital fabrication and some of the current and potential uses of that technology. A specific middle school study was conducted around STEM projects that used a 3D printer to help create an engineering project-based solution. © 2016 IEEE.

AUTHOR KEYWORDS: 3D printing; Digital fabrication; Middle school; STEM

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Benson, L.C.a , Kennedy, M.S.a , Ehlert, K.M.a , Vargas, P.M.D.a , Faber, C.J.b , Kajfez, R.L.c , McAlister, A.M.c

Understanding undergraduate engineering researchers and how they learn

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757630, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006826418&doi=10.1109%2fFIE.2016.7757630&partnerID=40&md5=17477fb9ad07dcafa6a2709291c25499

DOI: 10.1109/FIE.2016.7757630

AFFILIATIONS: Department of Engineering and Science Education, Clemson University, Clemson, SC, United States;

Department of Technological Studies, College of New Jersey, Ewing, NJ, United States;

Department of Engineering Education, Ohio State University, Columbus, OH, United States

ABSTRACT: As the need for qualified science, technology, engineering, and mathematics (STEM) graduates increases, there is an accompanying need for improved undergraduate STEM education. Undergraduate Research Experiences (UREs) have been shown to enhance an undergraduate student's academic experience; however, not all students can participate in or have access to UREs due to schedule constraints during the school year or other commitments in the summer. Our current research project seeks to determine how students develop a researcher identity and transform their epistemic beliefs through UREs. Elements identified to contribute to students' researcher identities and epistemic beliefs will then be translated into strategies that can be incorporated into traditional learning environments. This paper will overview the progress made in the first part of this multi-phase, multi-institution project and preliminary results from the initial surveys. © 2016 IEEE.

AUTHOR KEYWORDS: Epistemic beliefs; Researcher identity; Student perspectives; Undergraduate research experiences

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Nguyen, H.D., Nguyen, D., Pham, V.T.

Design an intelligent problem solver in solid geometry based on knowledge model about relations

(2016) Proceedings - 2016 8th International Conference on Knowledge and Systems Engineering, KSE 2016, art. no. 7758045, pp. 150-155.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007012821&doi=10.1109%2fKSE.2016.7758045&partnerID=40&md5=13ea40802d17a9f6b69e5f3b838ad114

DOI: 10.1109/KSE.2016.7758045

AFFILIATIONS: University of Information Technology, VNU-HCM, Ho Chi Minh City, Viet Nam

ABSTRACT: A grand challenge in knowledge representation is building the intelligent systems for Science Technology Engineering and Math (STEM) Education. In math education, the intelligent problem solver (IPS) must have sufficient knowledge to solve problems automatically, and their solutions are natural, step-by-step and can be understand by the learners. Besides that, Solid geometry is a hardly subject of mathematics to study for the high school studens. In this paper, an IPS in solid geometry is designed. The knowledge base of this system is represented based on Rela-model which is a knowledge model about relation. The inference engine of this system has been also built based on the algorithms to solve problems on objects and model. It shorn solution clearly and step-by-step. This system has been tested on various kinds of solid geometrical exercises in high-school mathematics of Vietnam education. © 2016 IEEE.

AUTHOR KEYWORDS: intelligent problem solver; knowledge representation; solid geometry

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Poindexter, C.a , Reinhart, D.b , Swan, B.c , McNeil, V.d

The University of Central Florida STEAM program: Where engineering education and Art Meet

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757414, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006817333&doi=10.1109%2fFIE.2016.7757414&partnerID=40&md5=b7b231e3dc13df7867be4f306b76b105

DOI: 10.1109/FIE.2016.7757414

AFFILIATIONS: School of Visual Arts and Design, University of Central Florida, Orlando, United States;

Civil, Environmental and Construction Engineering Department, University of Central Florida, Orlando, United States;

Program Evaluation and Educational Research Group, University of Central Florida, Orlando, United States

ABSTRACT: ICubed is a National Science Foundation (NSF) funded project housed at the University of Central Florida aimed at increasing participation in STEM fields through coordination and institutional integration. The University of Central Florida Science, Technology, Engineering, Arts and Mathematics (UCF STEAM) is a component of ICubed. As a part of this program, UCF STEM faculty and undergraduate researchers work collaboratively with faculty and students in the College of Arts and Humanities to create science-inspired art based on the STEM researcher's explanations of scientific concepts and possibilities. Since the program's inception in 2010, over 700 University of Central Florida faculty and students have participated in the STEAM program with a large majority coming from engineering fields. An evaluation of the program over the last six years demonstrates that by encouraging strong post-secondary cross-disciplinary collaborations, the UCF STEAM program has enlightened UCF's undergraduate engineering students in a manner that not only leads to greater recognition of the interdependencies of right-and left-brain directed skills but also has helped to improve learning and communication skills. This paper highlights UCF engineering STEAM activities and lends a discussion to the educational impact of such a program. © 2016 IEEE.

AUTHOR KEYWORDS: Art education; Engineering education; STEAM; STEM

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Zintgraff, C.

STEM professional volunteers in secondary STEM education: A study proposal to better understand the practices of educators

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7757050, pp. 552-554.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006840032&doi=10.1109%2fICALT.2016.115&partnerID=40&md5=084f2e9b1b016fe5ec37fa4cc5b467ff

DOI: 10.1109/ICALT.2016.115

AFFILIATIONS: Department of Learning Technologies, University of North Texas, Denton, TX, United States

ABSTRACT: Recent years have seen major growth in the use of STEM professionals in U.S. secondary school formal and informal programs. Assuming the important perspective of educators in the classroom, this Ph.D. Candidate is studying how educators recruit and deploy STEM professional volunteers in technology-driven STEM competition programs, with a focus on which practices educators find most valuable, and how the use of STEM professional volunteers does or does not relate to pedagogical practices. Study results will shed additional light on how technologies, educators and school settings interact to impact STEM programs that strongly incorporate technology as a driver for learning. © 2016 IEEE.

AUTHOR KEYWORDS: Industry; Professionals; STEM; Volunteers

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Dabipi, I., Zhang, L., Brown, W.L., Jr., Hartman, C.

Integrating complex aviation science projects into undergraduate engineering education with dialectic design approach and comparative performance analysis for innovative practices

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757745, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006826391&doi=10.1109%2fFIE.2016.7757745&partnerID=40&md5=db91932843a11f0ad80258492fc85f26

DOI: 10.1109/FIE.2016.7757745

AFFILIATIONS: Department of Engineering and Aviation Sciences, University of Maryland Eastern Shore, Princess Anne, MD, United States

ABSTRACT: Engineering students are challenged with implementing and developing systems within STEM disciplines. The dialectic design approach and comparative performance analysis were created for undergraduate engineering students as a teaching method to facilitate and improve student-learning experiences in STEM disciplines. We had found in our study that both the dialectic design approach and comparative performance analysis are critical to the theoretical development and the fundamental practices for engineering education in course learning objectives. These teaching methods were created for undergraduate engineering students to support specific interdisciplinary practices such as aviation sciences and course objectives focused on emerging issues concerning the design process and performance analysis. An undergraduate engineering course must promoted student-learning experiences for innovative practices through engineering models and performance analysis. The integration design in this course supported areas that include complex aviation science projects and the requirement constraints for system development. © 2016 IEEE.

AUTHOR KEYWORDS: Aviation science projects; Comparative performance analysis; Dialectic design approach; Engineering education; Interdisciplinary education

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

He, J.a , Lo, D.C.-T.a , Xie, Y.a , Lartigue, J.b

Integrating Internet of things (IoT) into STEM undergraduate education: Case study of a modern technology infused courseware for embedded system course

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757458, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006747319&doi=10.1109%2fFIE.2016.7757458&partnerID=40&md5=1635276e8c419b83fa1b31edb3113917

DOI: 10.1109/FIE.2016.7757458

AFFILIATIONS: Department of Computer Science, Kennesaw State University, Marietta, GA, United States;

Department of Software Engineering, Kennesaw State University, Marietta, GA, United States

ABSTRACT: Internet of Things (IoT) is rapidly emerging as the next generation of communication infrastructure, where myriad of multi-scale sensors and devices are seamlessly blended for ubiquitous computing and communication. The rapid growth of IoT applications has increased the demand for experienced professionals in the area. Since few, if any, dedicated IoT courses are currently offered, most Science, Technology, Engineering, and Mathematics (STEM) students will have limited or no exposure to IoT development until after graduation and entrance into the workforce. Moreover, there is a little room for adding additional courses into existing STEM curriculum. Therefore, we propose to transform STEM core courses by integrating IoT-based learning framework into their corresponding lab projects. The design challenges of the new learning framework is summarized in the paper. Subsequently, we propose the effective learning approaches to address those challenges. Moreover, in this paper, we present a case study by incorporating IoT-based learning framework into a Software Engineering (SWE) embedded system analysis & design course. Specifically, we introduce a lab development kit composed of Raspberry Pi/Arduino boards and a set of sensors with Zigbee supporting to provide wireless communication in the class lab section. We adopt module design method to design the course labware. Well-developed modules are presented and one sample module is illustrated in the paper. The labware is evaluated through survey questions. The majority of the students provided positive feedback and enjoyed the IoT-based lab development kit. © 2016 IEEE.

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Leberknight, C., Adamski, J., Kufel, S.

The class connect experimental test-bed: Pedagogical and architectural design considerations for E-learning

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7756924, pp. 70-71.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006905571&doi=10.1109%2fICALT.2016.125&partnerID=40&md5=61a0b7fa4b1b7bfe315ab86276a35fbe

DOI: 10.1109/ICALT.2016.125

AFFILIATIONS: Department of Computer Science, Montclair State University, Montclair, NJ, United States

ABSTRACT: Existing efforts are underway to increase undergraduate enrollment in science, engineering, technology, and mathematics (STEM). The STEM workforce is crucial to the U. S. health and economy, yet retention rates in STEM fields are poor and the U. S. is faced with a looming workforce shortage. This paper describes a novel system being developed, known as Class Connect, that aims to enhance instruction for STEM disciplines and function as a test-bed to examine various phenomena associated with peer instruction and student outcomes. © 2016 IEEE.

AUTHOR KEYWORDS: Adaptive learning; Evidence-based instruction; Intelligent system; Pedagogy; Peer instruction; Personlization

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Peixoto, A.

Girls in STEM: Increasing the number of female students entering technical fields

(2016) SA 2016 - SIGGRAPH ASIA 2016 Symposium on Education: Talks, art. no. 3006042, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006823512&doi=10.1145%2f2993363.3006042&partnerID=40&md5=8dc43c13b472c5191ea9ce24a5025a7a

DOI: 10.1145/2993363.3006042

AFFILIATIONS: CEFET/RJ, University of Kansas, United States

ABSTRACT: STEM is the acronyms for Science, Technology, Engineering and Mathematic, and refers to academic disciplines of technical fields. In most places of the word the number of female students that choose to go to an undergraduate course in technical fields is considerably smaller than the total number of women in society, that is near 50%. In this panel we discuss how to improve the number of female students and the possible causes of this phenomenon. The STEM is one of the fields that contributes significantly with the number of professionals for Computer Graphics, increase the number of female students in this field can have a good impact to increase the numbers of women working in Computer Graphics.

AUTHOR KEYWORDS: Computer graphics; Education; STEM

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Guerra, R.C.C.a , Smith, K.A.b c

I-Corps™ for Learning: Sustaining and scaling STEM education innovations for impact

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757391, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006757723&doi=10.1109%2fFIE.2016.7757391&partnerID=40&md5=9ac957b5cb0807cc7cc525d285aebb54

DOI: 10.1109/FIE.2016.7757391

AFFILIATIONS: American Society for Engineering Education, United States;

School of Engineering Education, Purdue University, United States;

Civil Engineering, University of Minnesota, United States

ABSTRACT: Currently there is a lot of emphasis on engineering education research and innovation. In 2014 NSF funded a pilot implementation of the NSF Innovation Corps for Learning (I-Corps™ L) and additional cohorts have been conducted and are planned. The 7-week I-Corps™ L program uses established strategies for start-ups to scale up and move teaching and learning innovations into broad practice. Participating teams go through a hypothesis-testing, scientific method of discovery to gather important insights and identify issues associated with their projects. Unfortunately, the reach of the program is limited as a maximum of 24 teams can participate in each course offering. This special session provides an opportunity for a broad cross-section of researchers and educators to gain exposure to the Lean Start Up approach and its applicability to STEM education ecosystem. The focus of the session is to introduce the core features of the Lean Start Up process: search for a sustainable and scalable model using the Business Model Canvas, Customer Discovery, and Agile Engineering (i.e., iterate and increment towards an appropriate 'product'). © 2016 IEEE.

AUTHOR KEYWORDS: Entrepreneurship; Innovation; Research impact

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Sergis, S.a b , Sampson, D.G.b c

Towards a teaching analytics tool for supporting reflective educational (re)design in Inquiry-based STEM Education

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7756986, pp. 314-318.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006870592&doi=10.1109%2fICALT.2016.134&partnerID=40&md5=92d6e1277cc21c0a9919b677e61f705b

DOI: 10.1109/ICALT.2016.134

AFFILIATIONS: Department of Digital Systems University of Piraeus Piraeus, Greece;

Information Technologies Institute CERTH Thessaloniki, Greece;

School of Education Curtin University of Technology Perth, Australia

ABSTRACT: Providing appropriate tool-supported guidance to students is an essential aspect of technology-supported inquirybased STEM education, in order to facilitate them in engaging in diverse inquiry tasks. However, analyzing educational designs and evaluating the level of tool-supported guidance provided towards reflective remedying actions is not a trivial task, especially for novice STEM teachers. In this context, the paper presents the design and preliminary evaluation of an inquiry-based STEM Teaching Analytics Tool. This tool aims to visually analyze and evaluate existing educational designs in terms of the level of technology-supported guidance they offer and support teachers' reflective (re)design. The preliminary evaluation results attest to the high levels of accuracy of the proposed Teaching Analytics Tool and provide evidence of its capacity to inform future Teaching and Learning Analytics tools for facilitating STEM teachers to engage in data-driven reflective (re)design of their practice. © 2016 IEEE.

AUTHOR KEYWORDS: Guidance; Inquiry-based STEM education; Scaffolds; Teaching analytics

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Ma, S.a , West, M.b , Herman, G.L.c , Tomkin, J.d , Mestre, J.e

Studying faculty communities of practice through social network analysis

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757561, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006713731&doi=10.1109%2fFIE.2016.7757561&partnerID=40&md5=7ffad8b85b36489d164c3cb50bb65c98

DOI: 10.1109/FIE.2016.7757561

AFFILIATIONS: Department of Educational Psychology, University of Illinois at Urbana-Champaign, Urbana, IL, United States;

Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States;

Illinois Foundry for Innovation in Engineering Education, University of Illinois at Urbana-Champaign, Urbana, IL, United States;

Department of Geology, University of Illinois at Urbana-Champaign, Urbana, IL, United States;

Department of Physics, University of Illinois at Urbana-Champaign, Urbana, IL, United States

ABSTRACT: Creating systemic change in undergraduate engineering and STEM education is difficult to achieve and just as difficult to study. It has been proposed that organizational learning and change theories can be coupled with social network analysis to achieve both of these goals. In this paper, we describe an institutional change effort designed around principles from Communities of Practice. We then present the design of a social analysis network study that we are executing to study and analyze whether this change effort has been successful in achieving its goals. We present some preliminary data to demonstrate the promise of this approach for executing and studying institutional change in engineering education and STEM education more broadly. © 2016 IEEE.

AUTHOR KEYWORDS: Communities of practice; Evidence-based instructional practices; Institutional change; Research-based instructional strategies; Social network analysis

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

DePue, T.H.a , Robistow, B.a , Newman, R.a , Mack, K.a , Banavar, M.K.a , Yang, T.a , Barry, D.a , Curtis, P.b , Spanias, A.b , Watkins, W.c

An android app for spatial acoustic analysis as a learning tool

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757538, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006815377&doi=10.1109%2fFIE.2016.7757538&partnerID=40&md5=9227432b6830a5a2de5505b6291aacd4

DOI: 10.1109/FIE.2016.7757538

AFFILIATIONS: Department of Electrical and Computer Engineering, Clarkson University, Potsdam, NY, United States;

SenSIP Center, School of ECEE, Arizona State University, Tempe, AZ, United States;

Systems Librarian, United States

ABSTRACT: An Android app has been developed to assist in the education of individuals in a science, technology, engineering, and mathematics (STEM) course of study. The Android Reflection Application provides students a means to determine distances to objects while allowing them the ability to manipulate signal envelopes, signal shapes, signal types, and frequency constraints. The convenient and intuitive graphical user interface immerses the user into a richly educational environment allowing for the solidification of fundamental concepts regarding digital signal processing (DSP). In addition to the educational benefits, this application is also being applied to spatial acoustic analysis and assistance in low-visibility. This feature will allow users to determine the best use for a given space whether it is a quiet study room or a room better suited for conference meetings. The effectiveness of this application has not yet been formally tested but suggests a positive result. © 2016 IEEE.

AUTHOR KEYWORDS: Android; Autocorrelation; DSP; Mobile echolocation; Signal processing; Spatial acoustic analysis

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Griffith, H.a , Griffith, A.b

A dynamic learning model for accelerated pre-matriculation mathematics programs: A work-in-progress

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757455, .

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DOI: 10.1109/FIE.2016.7757455

AFFILIATIONS: Michigan State University, East Lansing, MI, United States;

Wright State University, Dayton, OH, United States

ABSTRACT: Accelerated pre-matriculation mathematics remediation programs are a popular strategy for improving the placement levels of underprepared students. Although limited assessments of such programs have been reported in the literature, most work is focused either on immediate placement level improvement or longitudinal indicators of student success. While valuable, both techniques offer no insight regarding the learning progression of students while participating in the program, which is of tremendous value in optimizing program policy, such as determining the ideal number of contact hours. The research described herein proposes a first-order dynamic learning model for describing students' content acquisition process within accelerated remediation programs. Details regarding model formulation are presented within this work-in-progress paper. A brief evaluation of model efficacy is also conducted using data gathered from daily ALEKS learning assessments employed within a one-week remediation program for intending engineering students. © 2016 IEEE.

AUTHOR KEYWORDS: Computer based learning; Preparation; Time to degree

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Banks-Hunt, J.M., Adams, S., Ganter, S., Bohorquez, J.C.

K-12 STEM Education: Bringing the engineering maker space, student-centered learning, curriculum, and teacher training to middle schools

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757531, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006823476&doi=10.1109%2fFIE.2016.7757531&partnerID=40&md5=a15af751b742d0b3f55f2b11af75ae22

DOI: 10.1109/FIE.2016.7757531

AFFILIATIONS: Virginia Tech University Blacksburg, Blacksburg, United States

ABSTRACT: Encouraging our youth to pursue careers in science, technology, engineering, and mathematics (STEM) fields has become critically important to meeting needs for adequate and clean water, less pollution and an adequate food supply, along with needs for housing, communications, and sustained technology leadership. According to the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, the future of STEM fields is dependent on a steady workforce of talented and diverse individuals. Without a growing pool of STEM talent with emphasis upon the 'E', the Bureau of Statistics projects that the U.S. will have a difficult time filling the demands for STEM professionals as near as the year 2018. In response to the need to develop a STEM proficient workforce with emphasis upon the 'E', an industry leading high-tech corporation on the west coast developed a hands-on engineering maker space that exposes middle school students to an exciting one-day authentic learning experience. Announced January 2016, Virginia Tech and the high-tech corporation entered into a multi-year, multi-phase partnership agreement to develop programmatic curricula, teacher credentialing and professional development, hands-on engineering practices, activities for long-term student engagement, and ongoing research. The purpose of this work-in-progress article is to report on the first phase of the partnership agreement and its innovative practices of interest to stakeholders invested in the K-12 engineering footprint. © 2016 IEEE.

AUTHOR KEYWORDS: Hands-on engineering; Maker space; Programmatic curriculum; Teacher credentialing and professional development

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Estela-Carbonell, M.R.a , Codina, A.a , Poblet-Puig, J.a , Pardo, P.a , Puigví, M.A.a , Pujadas, E.a , Valls, S.a , Álvarez, M.D.b , Guaus, E.b , Hervada-Sala, C.b , MacAnás, J.b , Masip-Álvarez, A.b , Morillo, M.b , Nejjari, F.b

Towards the STEM knowledge homogenization of pre-university students in 21st century: MOOC: the Language for Engineering

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DOI: 10.1109/FIE.2016.7757358

AFFILIATIONS: E.T.S. d'Enginyers de Camins, Canals i Ports, Universitat Politècnica de Catalunya, BarcelonaTech, Barcelona, Spain;

Escola Superior d'Enginyeries Industria, Aeroespacial i Audiovisual de Terrassa, Universitat Politècnica de Catalunya, BarcelonaTech, Barcelona, Spain

ABSTRACT: For the past five years, Engineering students from Barcelona School of Civil Engineer in UPC BarcelonaTech have shown that educational intervention in first-year engineering programs can positively affect students' awareness of Science, Technology, Engineering and Mathematics (STEM) concepts by introducing students to basics concepts and motivating them to follow next ones. At Terrassa School of Industrial, Aerospace and Audiovisual Engineering, also belonging to UPC BarcelonaTech, STEM concepts are strengthen to high school students by means of the Mercat de Tecnologia, (a science fair among schools) and by some recommended but not compulsory propaedeutic courses of basic subjects, carried out the week prior to the official start of university studies. Still, many students entering university show some lacks on theoretical items, particularly those who do not follow the usual way to access to tertiary studies after obligatory secondary education but a parallel and more practical one. In fact, there is a large heterogeneity in terms of the average previous knowledge of every subject as well as in the individual curriculum of each student, since they might have enrolled different courses before entering the university. Due to those lacks, some professors at both aforementioned schools have developed a MOOC oriented to new university students. The designed MOOC is useful in order to improve the basic knowledge of new students regarding these sciences. © 2016 IEEE.

AUTHOR KEYWORDS: Engineering; MOOC; Self-learning; STEM

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Khanlari, A.

Long term effects of educational robots on a Grade 9 girl's perceptions of science and math

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https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006757190&doi=10.1109%2fFIE.2016.7757649&partnerID=40&md5=66c2a2ff329e59f557defe8e82566ae0

DOI: 10.1109/FIE.2016.7757649

AFFILIATIONS: University of Toronto, Canada

ABSTRACT: A review of literature highlighted a few important aspects of using robotics for educational purposes. However, most of the studies did not examine the long term effects of educational robots, but only considered a short period of time, when their participants were involved in robotics courses. Also, in most of the studies, the gender differences are not considered and the effects of robotics on girls are overlooked. This case study examines the effects of educational robots on Sarah, a grade 9 student who has attended in a robotics summer camp when she finished her Grade 8. The participants of this study include Sarah and her mother, who is a science teacher. This case study examines the long term effects of educational robots on Sarah, almost one year after she finished her summer camp robotics course. Based on the preliminary results of this study, the long term effects of robotics on Sarah include motivating her to learn mathematics, science, and technology. The results also show that using robotics in the education system would result in fewer gender-based stereotypes, regarding technical majors and careers. This study shows that robotics also could create an environment where Sarah, as a girl, were immersed in authentic education, and helped her improve her critical thinking and problem solving skills. © 2016 IEEE.

AUTHOR KEYWORDS: Girls' perceptions; Math education; Robotics; Science education

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Yeh, M.K.-C.a , Toshtzar, A.a , Guertin, L.b , Yan, Y.c

Using spaced repetition and gamification to enhance K-12 student science literacy with on-demand mobile short reads

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DOI: 10.1109/FIE.2016.7757361

AFFILIATIONS: Information Sciences and Technology, Penn State University, United States;

Earth Sciences, Penn State University, United States;

Learning, Design and Technology, Penn State University, United States

ABSTRACT: We present a work-in-progress project that implements spaced repetition and gamification through mobile application for STEM education as a learning system for K-12 students. Spaced repetition in the classroom has been studied and shown to be effective for foreign language and vocabulary acquisition as well as other types of training, while gamification has similarly been used to improve learners' engagement and motivation. This project combines the advantages of both instructional strategies and delivers it through a mobile learning system by using its ubiquitous nature. We believe by combining spacing and gamification with mobile learning technology, the learning system will yield fruitful results in STEM education. We discuss how existing literature affects our design and our plan of implementing such a system. © 2016 IEEE.

AUTHOR KEYWORDS: Gamification; Mobile learning; Spaced repetition; STEM education; Ubiquitous learning

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Mondisa, J.-L., Millunchick, J., Davis, C., Koch, D.

The University of Michigan's M-STEM academies program: Examining the social community of future engineers

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DOI: 10.1109/FIE.2016.7757747

AFFILIATIONS: University of Michigan, Ann Arbor, United States

ABSTRACT: A social community framework is used to examine the program elements of the University of Michigan's (UM) M-Engin Program, an undergraduate engineering mentoring program, to provide insights about its social community elements. At this initial research stage, a methodical analysis of the program data (e.g., analytics, features, elements, and artifacts) was performed to create a portfolio to begin to understand the role of social community within the M-Engin Program. From this research, we can learn how to better serve members of various program communities by identifying opportunities for improvement. Future research will include conducting informal interviews with the program's coordinators and surveying and interviewing program participants. © 2016 IEEE.

AUTHOR KEYWORDS: Mentoring; Social community; Underrepresented students

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Ghalia, M.B.a , Carlson, R.b , Estrada, V.c , Huq, H.a , Ramos, J.a

Engaging K-12 teachers in engineering through a professional development program: Implementation strategies, results and lessons learned

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DOI: 10.1109/FIE.2016.7757530

AFFILIATIONS: Department of Electrical Engineering, University of Texas Rio Grande Valley, Edinburg, TX, United States;

Department of Human Development and School Services, University of Texas Rio Grande Valley, Edinburg, TX, United States;

Departmemt of Teaching and Learning, University of Texas Rio Grande Valley, Edinburg, TX, United States

ABSTRACT: In order for the United States to remain the global leader in engineering and technology, it must produce and retain a higher number of science, technology, engineering, and mathematics (STEM) talent. Over the past few decades, there have been a number of national initiatives that have promoted STEM education with the goal of generating student interest in science and engineering and increasing the number of students entering the STEM pipeline. Research literature confirms that teachers are the single most important factor affecting student achievement and interest in STEM subjects. Several models of teacher professional development have been reported along with the evidence of the degree of their effectiveness in promoting student interest in engineering. These professional development programs are designed to increase the engineering content knowledge of math and science teachers, thereby having a direct impact on student achievement in math and science and helping to promote a positive attitude to engineering. This paper presents the design of a teacher professional development program offered in a predominantly Hispanic region in South Texas. The professional development program provides an opportunity for teachers to participate in engineering projects, become more knowledgeable about the engineering profession, and learn new pedagogical tools that they use to develop engineering-based hands-on learning activities for their classrooms. One of the effective approaches adopted by this program is the development of creative engineering connections between the math and science concepts taught by the teacher participants and real-world engineering applications that not only can K-12 students easily understand, but also find tangible and interesting. The paper also provides evidence of the effectiveness of the program strategies that have resulted in about 89% of the developed learning activities being successfully implemented in the teachers' classrooms. The results of the program teacher surveys and discussion of lessons learned by the program management are also presented. © 2016 IEEE.

AUTHOR KEYWORDS: K-12 engineering education; Teacher professional development

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Venter, M.a , De Wet, L.b

Continuance use intention of primary school learners towards mobile mathematical applications

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DOI: 10.1109/FIE.2016.7757539

AFFILIATIONS: Information Technology Department, Central University of Technology, Bloemfontein, South Africa;

Department of Computer Science and Informatics, University of the Free State, Bloemfontein, South Africa

ABSTRACT: Mobile educational applications include some of the most useful learning tools that have ever been developed. Games for learning are most effective when multiple sessions are involved, in other words, when users replay the games. Previous research on the use of educational games in mathematics education have focused primarily on the learning potential of these games and have not adequately addressed the continuance use intention, or the replay value, of these games. This is a serious gap in literature due to the fact that mobile mathematical applications will only be able to assist primary school learners to improve their math skills if they continue to use these apps on a regular basis. The purpose of this paper is to address this gap by investigating the continuance use intention of primary school learners towards mobile educational mathematical applications. This study adopted the Flow Theory, GameFlow and EGameFlow model, Game Based Learning model and the Technology Acceptance Model adapted to mobile gaming as theoretical base. A mixed method research methodology was employed where qualitative and quantitative data was gathered through surveys, individual observations and focus groups. Twenty-six children, aged 10 to 13, from selected schools in one of South Africa's provinces, participated in the study. The results indicate that the fun, fantasy, immersion and sensation constructs were the most influential in terms of the continuance use intention. The findings of this study could be used by educators and designers of educational mathematical applications in the evaluation of the re-use potential of these applications. © 2016 IEEE.

AUTHOR KEYWORDS: Continuance use intention; Mathematical applications; Mathematical games; Mobile games; Primary school learners

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Griggs, L.a , Stringer, J.K.b , Rankins, F.b , Hargraves, R.H.c

Investigating the impact of a hybrid summer transition program

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DOI: 10.1109/FIE.2016.7757527

AFFILIATIONS: Biomedical Engineering, Virginia Commonwealth University, Richmond, VA, United States;

Foundations of Education, Virginia Commonwealth University, Richmond, VA, United States;

Teaching and Learning, Electrical and Computer Engineering, Virginia Commonwealth University, Richmond, VA, United States

ABSTRACT: Pre-college summer transition programs are prevalent at colleges and universities around the country and are generally associated with positive impacts on student retention and graduation rates. At Virginia Commonwealth University, a six week hybrid on-campus/online program is offered to incoming science, technology, engineering, and mathematics majors from racial and ethnic backgrounds underrepresented in those disciplines (i.e., African American, Latino/a, Native American). This work-in-progress investigates the participants' perceptions of the program in facilitating their academic and social integration into the university. An explanatory mixed methods approach is used. Participants perceive the hybrid program to have played a vital role in their social integration and an integral role in supporting their academic integration into the university. © 2016 IEEE.

AUTHOR KEYWORDS: Academic integration; Social integration; Summer transition programs; Underrepresented students

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Serrano, M.I.a b , Groh, J.L.a

Travel grants which facilitate engineering leadership identity in female engineering students

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DOI: 10.1109/FIE.2016.7757642

AFFILIATIONS: Women in Engineering Program, Purdue University, West Lafayette, IN, United States;

Polytechnic Institute, Purdue University, West Lafayette, IN, United States

ABSTRACT: In this pilot mixed methods study, we examine the impact of travel grants for female undergraduate and graduate engineering students at a large Midwestern university to attend non-technical conferences whose focus is on the development and empowerment of female leaders in science, technology, engineering and mathematics (STEM). Using a leader identity development framework, we analyzed applications, post-conference attendance surveys, required dissemination projects (i.e., sharing what was learned at the conference with the wider engineering audience at the university) and interview transcripts to examine the impact of this conference experience approach on participants' attitudes towards their anticipated degree and career paths. With an initial sample of 27 participants, preliminary results show a positive impact on professional and personal development, an increased commitment to completing current degree programs, an increase in/reinforcement of confidence in abilities, and inspiration to emulate the women leaders with whom the participants networked at the conference. © 2016 IEEE.

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Dele-Ajayi, O., Sanderson, J., Strachan, R., Pickard, A.

Learning mathematics through serious games: An engagement framework

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757401, .

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DOI: 10.1109/FIE.2016.7757401

AFFILIATIONS: Faculty of Engineering and Environment, Northumbria University, Newcastle-Upon-Tyne, United Kingdom

ABSTRACT: Digital games have become part of childhood and adolescence. The debate has moved from should teenagers play digital games to how to gain benefits from this gameplay. Researchers predict that technology-enhanced learning will increase with educational computer games (serious games) playing an important role. Although serious games are often built on established educational theories, they can also appear boring and struggle to engage the learner. Analyses of serious games demonstrate that many do not offer an entertainment experience comparable to or even recognizable as relatives of the entertainment games familiar to many players. However, a high level of engagement by the learner is viewed as necessary to provide a strong learning environment. The long-term aim of this study is to explore how digital games can support a more engaging and effective mathematics learning experience. This first stage has taken a qualitative grounded theory approach to explore the engagement factors of digital games among young people (aged 7-16 years). Analyses of data gathered through a combination of surveys and interviews have led to a framework of engagement factors. This provides a basis for designing serious games that are effective by being both engaging and educational. © 2016 IEEE.

AUTHOR KEYWORDS: Active learning; Game-based learning; Serious games; Technology-enhanced learning; Young people

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Carvalho, D.G., Lins, W.C.B.

LabDuino: An open source tool for science education

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DOI: 10.1109/FIE.2016.7757360

AFFILIATIONS: Centro de Estudos Avançados Do Recife-C.E.S.A.R.edu, Recife, Brazil

ABSTRACT: Research shows that the poor quality of science education and related areas in the Brazilian basic education has been negatively affecting professionals training in research and scientific development, also contributes to high rates of evasion of STEM graduation courses. Also, scientific illiteracy are harmful to society, once it's members losses analytical judgment capability and by that are more influenceable. Therefore, it is necessary to obtain ways to reverse this situation. Inspired by Seymour Papert ideas on constructionism and the maker movement, this paper proposes an opensource embedded tool for science experimentation on K-12 classes. Created over Arduino development board and mounted on a custom circuit board, designed on an open source tool, and embedded on a laser cut box, this tool, called LabDuino, works like an experiment repository, where the student can choose the subject to be explored, then an experiment and run it following instructions, (sensors setup, initial data and so on), presented on the tool's display. The LabDuino is capable to gathering, process, show and optionally store on SD card, up to eight sensors data, promoting a hands-on experience from setting up to experiment execution in a seamless way. It was tested on a Brazilian seventh grade class, where was taught gravity force and it's effects by doing a dropping test, inspired on egg drop experiment. Was observed an increase of 14% on the experiment class grades and a more engaged students by running the experiments. © 2016 IEEE.

AUTHOR KEYWORDS: Arduino; Constructionism; Educational Technology; Embedded Software; LabDuino; Scientific Education; STEM

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Reimers, A.a , Smith, J.F.b

Enriching an informal engineering education program with social relevance and history for middle school girls

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DOI: 10.1109/FIE.2016.7757730

AFFILIATIONS: Department of Engineering and Society, University of Virginia, Charlottesville, VA, United States;

Philadelphia Writing Project, University of Pennsylvania, Philadelphia, PA, United States

ABSTRACT: Two educators collaborated to design and test a one-week summer course for middle school girls on sound, engineering, and invention as an exemplar integrated STEM program that draws upon rich historical and social contexts with the goal of attracting and retaining students in STEM. An engineering design project and an invention project formed the core of the course. Music and related technologies served as the unifying theme intended to tap into the interests of youth. Historical primary sources and writing about invention and innovation provided additional entry points into engineering as a human and creative endeavor. Exposure to female inventors, scientists and engineers was also planned as a way for the girls to become acquainted with positive role models. Included in this paper is a discussion of the underlying philosophies that influenced the design of the learning experiences for youth underrepresented in STEM. © 2016 IEEE.

AUTHOR KEYWORDS: Engineering; Girls; History; Informal; Integrated STEM; Middle school; Primary source; Sound

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Kenwright, B.

Holistic game development curriculum

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DOI: 10.1145/2993352.2993354

ABSTRACT: This article discusses the design and implementation of a holistic game development curriculum. We focus on a technical degree centred around game engineering/technologies with transferable skills, problem solving, mathematics, software engineering, scalability, and industry practices. In view of the fact that there is a growing skills shortage for technically minded game engineers, we must also be aware of the rapidly changing advancements in hardware, technologies, and industry. Firstly, we want a synergistic game orientated curriculum (for a 4-year Bachelor's programme). Secondly, the organisation and teaching needs to adapt to future trends, while avoiding tunnel vision (too game orientated) and support both research and industry needs. Finally, we build upon collaborations with independent experts to support an educational programme with a diverse range of skills. The curriculum discussed in this article, connects with a wide variety of subjects (while strengthening and supporting one another), such as, programming, mathematics, computer graphics, physics-based animation, parallel systems, and artificial intelligence. All things considered, the development and incorporation of procedures into a curriculum framework to keep up with advancements in game technologies is important and valuable. Collaborative learning Computing education programs Contextual software domains Virtual worlds software. © 2016 Copyright held by the owner/author(s). SA '16 Symposium on Education, December 05-08, 2016, Macao.

AUTHOR KEYWORDS: Curriculum; Degree; Education; Game development; Holistic; Learning; Teaching; Technologies

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Naz, A.a , Lu, M.a , Hatipoglu, K.a , Rambo-Hernandez, K.b

Employing project-based learning to address the Next Generation mathematics standards in high schools

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DOI: 10.1109/FIE.2016.7757359

AFFILIATIONS: West Virginia University Institute of Technology, Montgomery, WV, United States;

College of Education and Human Services, West Virginia University, Morgantown, WV, United States

ABSTRACT: In the summer of 2015, a five-day professional development workshop was held at West Virginia University Institute of Technology, located in Montgomery, West Virginia, with the objective of providing systematic training of project-based learning to high school math teachers. Twenty-two teachers participated in the workshop. Instructors of the workshop were faculty members from West Virginia University Institute of Technology, West Virginia University, and West Virginia State University. The workshop's focus was project-based learning, which employs projects closely related to real-world applications to facilitate delivering abstract concepts. Specifically during the workshop, the participating high school math teachers learned designing engineering projects, mapping engineering projects to Next Generation math standards/objectives, and assessing the outcomes of project-based learning. Each participating teacher is required to implement at least one engineering project in his/her math class and the results will be collected by the superintendents of the three participating school districts. The workshop has two primary hypotheses: (i) teachers who participated in the workshop will increase their self-efficacy toward implementing project-based learning, applying engineering and technology to address content standards and objectives, and using assessments to inform instruction, and (ii) project-based learning will improve students' self-efficacy and learning effectiveness in math, and in turn, will increase their interest/intention to pursue STEM disciplines. The impact of the workshop on teachers is determined through surveys and interviews. Social Cognitive Career Theory is applied to evaluate the impact of project-based learning on the participating teachers' students. Results of the surveys, interviews, and student performance will be presented at the conference. © 2016 IEEE.

AUTHOR KEYWORDS: High school; Mathematics education; Project-based learning

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Kennedy, J.a , Lee, E.b , Fontecchio, A.c

STEAM approach by integrating the arts and STEM through origami in K-12

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DOI: 10.1109/FIE.2016.7757415

AFFILIATIONS: ECE Department, Drexel University, Philadelphia, PA, United States;

GAMP High School, Philadelphia, PA, United States;

Graduate College, Drexel University, Philadelphia, PA, United States

ABSTRACT: While science, technology, engineering and math hold the fastest growing fields today, only 44% and 36% of students are math and science ready, respectively, to enter college. By integrating the arts into STEM, a four-part origami based curriculum has been developed, which combines the topics of renewable energy, architecture design, 3D CAD design and printing, and mathematic, science, and engineering principles. The modules are composed of familiar engineering education tactics to get students to think outside of the box like an engineer. Students reverse engineer origami pieces, build an origami chair using the design process, and learn the topic of renewable energies through interactive games. The final module pulls the knowledge gained from the first three together. The students design and 3D print origami structures that are energy efficient and utilizes at least one source of renewable energy. Students go through the design process with brainstorming, prototyping, and working models. The K-12 Next Generation Science Standards for science and engineering has eight practices. Origami Meets STEAM practices all eight including: (1) Asking questions and defining problems, (2) Developing and using models, (3) Planning and carrying out investigations, and (6) Instructing explanations and designing solutions. This project has been introduced to 9th and 10th grade geometry classes. Surveys were given to gauge the effectiveness of activities with the students, teachers, and participating graduate students. This is a work in progress and results of the surveys and work are still being processed. © 2016 IEEE.

AUTHOR KEYWORDS: Geometry; K-12 STEM Education; NGSS; Origami

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Sundaram, R.

Engage and educate: Engineering laboratory activities for first-year engineering students

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DOI: 10.1109/FIE.2016.7757662

AFFILIATIONS: Gannon University, United States

ABSTRACT: This paper discusses the importance and effectiveness of structured hands-on STEM-related project-based engineering laboratory activities in the critical entry-level course, First-Year Seminar in Engineering, for undergraduate engineering majors at ABET-accredited institutions of higher education. At our institution, the First-Year Seminar in Engineering is offered once each year during the fall term. The enrollment in this course ranges from ninety to hundred first-year students who are expected to graduate with engineering degrees from the four-year ABET-accredited programs. One component of this course comprises hands-on engineering laboratory activities in sessions of short duration (fifty-five minutes apiece) in disciplines such as Biomedical Engineering (BME), Electrical and Computer Engineering (ECE), Environmental Engineering (ENV), and Mechanical Engineering (ME). In the short interval of time allotted for STEM-based laboratory experiences, the motivation, commitment, and level of engagement can range from total indifference to unbridled enthusiasm with the desire to do and learn more. The broad goal is to deliver key aspects of the engineering design process, from concept-to-product (the E in STEM), during this short interval of time. Therefore, it behooves us to develop STEM-based, project-oriented laboratory activities that focus the student on well-defined, easy-to-attain, yet insightful experimental objectives. © 2016 IEEE.

AUTHOR KEYWORDS: ECE laboratory; STEM engineering education

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Terracina, A.a , Berta, R.b , Bordini, F.c , Damilano, R.c , Mecella, M.a

Teaching STEM through a role-playing serious game and intelligent pedagogical agents

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7756945, pp. 148-152.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006957588&doi=10.1109%2fICALT.2016.121&partnerID=40&md5=5f5719969b2e607a2a8234b965f4e07e

DOI: 10.1109/ICALT.2016.121

AFFILIATIONS: Sapienza Università di Roma, Italy;

Università di Genoa, Italy;

ITIS Cartesio-Luxemburg, Roma, Italy

ABSTRACT: Teaching STEM is a promising application domain for game-based instructional methods. In this paper we present a serious game organized as a role playing game: players learn how to inhabit the headspace of someone other than their primary ego identity, offering them the chance to develop a stronger sense of empathy. The same empathy is established between the player and her Intelligent Pedagogical Agent, which should guide the player into the Virtual Learning Environment and trough the game as well. We present the ongoing development of the game, and a preliminary validation of the Intelligent Pedagogical Agent to show its effectiveness with teenager students. © 2016 IEEE.

AUTHOR KEYWORDS: Game Based Learning; Intelligent Pedagogical Agent; Virtual Learning Environment

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Estela-Carbonell, M.R., Diez, P.

Internet-based tutorial providing mathematical complements for technical Master students: TIMEMathCom

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757454, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006830344&doi=10.1109%2fFIE.2016.7757454&partnerID=40&md5=8259bfda234a3955da03bf4b0a377819

DOI: 10.1109/FIE.2016.7757454

AFFILIATIONS: E.T.S. d'Enginyers de Camins Canals i Ports, Universitat Politècnica de Catalunya, BarcelonaTech, Barcelona, Spain

ABSTRACT: The mathematical background of international students in Technical Master programs is pretty heterogeneous. They often lack of a sound basis in specific topics, which are necessary to follow the Master. Filling this gap is often stressing because it requires these students to make an additional effort reviewing basic references. The goal of this initiative is to produce a tailored learning tool for these students. Previous experiences of the proposing teams suggest that using a Moodle environment is a suitable choice to develop the tool. The idea is to cover synthetically the topics and to allow getting acquainted with the knowledge in a straight-to-the point approach. T.I.M.E. is a network assembling more than 50 Higher Education Institutions (mostly in Europe) with a focus in Scientific and Technical training. T.I.M.E. provides an ideal framework for developing and testing the tool. This is because the contents are enriched by the feedback of the experience of the members involved. Moreover, T.I.M.E. community is a perfect test bench for the tool. © 2016 IEEE.

AUTHOR KEYWORDS: Mathematics; Self-assessment; Technical master students; Virtual learning tools; WIRIS

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Konert, J.a , Bohr, C.b , Bellhauser, H.b , Rensing, C.c

PeerLA - Assistant for individual learning goals and self-regulation competency improvement in online learning scenarios

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7756920, pp. 52-56.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006944023&doi=10.1109%2fICALT.2016.100&partnerID=40&md5=7975df9ec67b0af2cc38d236d730b88a

DOI: 10.1109/ICALT.2016.100

AFFILIATIONS: Department VI Information Technology and Media, Beuth University of Applied Sciences, Berlin, Germany;

Department of Electrical Engineering and Information, Technische Universität Darmstadt, Technology, Darmstadt, Germany;

Department of Psychology, Johannes Gutenberg-Universität Mainz, Mainz, Germany

ABSTRACT: While online learning is already a part of university education and didactics, not all students have the necessary self-regulation competency to really learn on their own efficiently and effectively. In classroom a teacher can take over a moderating part, set intermediate goals and give feedback to one's progress, but participants of online learning courses (e.g. in blended scenarios or Massive Open Online Courses (MOOCs)) face a higher demand of self-regulation competency. This paper presents a course and content independent assistant, PeerLA, which assists in improving self-regulation competency. PeerLA allows setting of long-term goals, breakdown into intermediate goals and keeps track of knowledge increase or time needed. A graphical feedback allows comparison of existing and aimed level of knowledge or time investments. PeerLA adds peer comparison to the visualization charts for social frame of reference. This comparison is course-wide or only with similar learners (close in goals and knowledge levels). PeerLA is implemented as a Learning Management System (LMS) plugin to support learning progress in mixed formal and informal learning scenarios. PeerLA was evaluated with 83 students in an online mathematics preparation course over four weeks. Results indicate the benefits of such a self-regulation assistance, especially for university freshmen. © 2016 IEEE.

AUTHOR KEYWORDS: Blended learning; Guidance; Peer learning analytics; Scaffolding; SCRUM; Self-regulation competency; Visualization

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Siegel, R.a , Saper, M.a , Tanu, E.a , Zastavker, Y.V.a , Stolk, J.D.a , Dillon, A.a , Gross, M.D.b

The promise of faculty care in undergraduate STEM courses

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757732, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006713301&doi=10.1109%2fFIE.2016.7757732&partnerID=40&md5=087279c30fe0fdedd31cf526a8a6c3de

DOI: 10.1109/FIE.2016.7757732

AFFILIATIONS: Franklin W. Olin College of Engineering, Needham, MA, United States;

Wake Forest University, Winston-Salem, NC, United States

ABSTRACT: Work in Progress. Introductory, or "weed out" chemistry courses are well-known for deterring undergraduate students from pursuing STEM (Science, Technology, Engineering, and Mathematics) fields. Specifically, students' motivations resulting from experiences in these courses can influence STEM retention. Using grounded theory, our preliminary analysis of qualitative data collected in an undergraduate chemistry course has identified "faculty care" as an emergent construct of importance to student motivations. Our emergent definition of care is students' perception that their instructors recognize and communicate actionable steps towards self-improvement or illustrate concern, encouragement, or relational interest for the students in academic and non-academic settings, or in an unexpected, personal way. We found that students hold gendered interpretations of faculty care, and these interpretations may give rise to gendered motivational attitudes. This work raises questions about the ways specific classroom activities or faculty-student interactions allow faculty to communicate a sense of care for their students and thereby affect students' motivational attitudes in their classrooms. More broadly, this work may have implications for our understanding of the ways faculty can address gendered patterns in STEM participation. © 2016 IEEE.

AUTHOR KEYWORDS: Affect; Care; Emotion; Faculty-student interaction; Gender; Motivation; Relatedness

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Toyoshima, J.a , Fujii, S.b , Tokiwa, Y.b

Development of a mobile-friendly classroom support system to improve students' presentation skills

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757542, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006710560&doi=10.1109%2fFIE.2016.7757542&partnerID=40&md5=0999a9ad56ff1b2c814f5f626cbe4ef5

DOI: 10.1109/FIE.2016.7757542

AFFILIATIONS: Department of Engineering and Design, Hosei University, Tokyo, Japan;

Research Center for Computing and Multimedia Studies, Hosei University, Tokyo, Japan

ABSTRACT: Work in Progress: Communication skills are indispensable for becoming successful in the global engineering community. Among various communication skills, presentation skills are regarded as one of the greatest career enhancers for engineers. Nevertheless, it is the weakest skill of most Japanese engineering students. To overcome this inadequacy, we offered a presentation skills course for sophomore Science, Technology, Engineering, and Mathematics (STEM) students by integrating video streaming and numerical peer evaluation using IT technology. This paper examines the feasibility and the students' acceptability of the newly developed IT peer evaluation system. In implementing the system, three research questions were posed: 1. Does the new system facilitate classroom management? 2. Is the new system more accepted than the existing paper-based method by the students? 3. Does the new system promote the overall improvement of students' presentation skills? The preliminary results showed that the new system facilitated classroom management, and that it was accepted by the students primarily due to its functional requirement such as utility and non-functional requirement such as promptness. Furthermore, the students' average numerical peer evaluation scores of physical messages and audience interaction mostly improved. © 2016 IEEE.

AUTHOR KEYWORDS: Classroom support system; Peer evaluation; Presentation skills

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Walters, S.a , Santana, C.a , Zastavker, Y.V.a , Dillon, A.a , Stolk, J.D.a , Gross, M.D.b

Students' motivational attitudes in introductory STEM courses: The relationship between assessment and externalization

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757629, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006830346&doi=10.1109%2fFIE.2016.7757629&partnerID=40&md5=066e5317b1a0e79c5a4912aa2e70d7cd

DOI: 10.1109/FIE.2016.7757629

AFFILIATIONS: Franklin W. Olin College of Engineering, Needham, MA, United States;

Wake Forest University, Winston-Salem, NC, United States

ABSTRACT: Work-in-Progress. Students' contextual motivation in introductory STEM (Science, Technology, Engineering, and Mathematics) courses has been a focus of many recent studies; this work provides a new lens to this work by investigating students' situational motivations. Grounded theory is used to analyze survey responses from ten students in an introductory STEM course at a small private technical school that features project-based learning environments. Analysis resulted in an emerging relationship between assessment and a behavior we call externalization. We observe a co-occurrence between externalization and problem-set-related assessment; the co-occurrence indicates that some students may not feel as though they have control over their progress and performance on problem sets and it is this lack of control that the students report to be frustrating and amotivating. Additionally, we observe that blame is presented either as externalization or non-externalization while credit is almost always non-externalized. The two presentations of blame suggest that students might externalize to cope with negative affective experiences. The results of this study may have implication for design of STEM courses with motivations as both means and ends in students' learning processes. © 2016 IEEE.

AUTHOR KEYWORDS: Autonomy; Emotion; Empowerment; Internalization; Motivation; Project-based learning; Relevance

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Padwick, A., Dele-Ajayi, O., Davenport, C., Strachan, R.

Innovative methods for evaluating the science capital of young children

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757680, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006762228&doi=10.1109%2fFIE.2016.7757680&partnerID=40&md5=55cc4e1b97bbce3bbb68294c14072b4c

DOI: 10.1109/FIE.2016.7757680

AFFILIATIONS: Faculty of Engineering and Environment, Northumbria University, Newcastle-Upon-Tyne, United Kingdom

ABSTRACT: Considerable effort has been spent on interventions to increase the numbers/diversity of young people studying Science, Technology, Engineering and Mathematics (STEM) and/or entering STEM related careers with little evidence of their effectiveness. In the UK, less than 10% of professional engineers are female. Science capital is a recent concept for capturing those elements that influence children's choice of a science-related career. Children with higher science capital are more likely to choose a STEM career than those with lower science capital and therefore interventions to increase science capital are needed. Initially studies evaluating science capital have focused on secondary age children (aged 11 - 18 years). Here a research approach for evaluating science capital among primary age children (aged 7 - 11 years) is presented using a mixed methods approach. Results indicate that children share similar perceptions of scientists as 'hardworking', 'clever' and 'creative' independent of gender, age and science capital. However, children's self-identify differed by gender, age and science capital, illustrating significant gaps for some children between their self-identity and that of a scientist. Interventions focusing on narrowing this gap should increase the likelihood of them considering a science-related career. © 2016 IEEE.

AUTHOR KEYWORDS: Career advice and guidance; Diversity; Gender; Research methods; Science capital; Science education; STEM outreach; Young people

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Mihalec-Adkins, B.a , Hicks, N.b , Douglas, K.A.b , Diefes-Dux, H.b , Bermel, P.c , Madhavan, K.b

Surveying the motivations of groups of learners in highly-technical STEM MOOCs

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757376, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006836948&doi=10.1109%2fFIE.2016.7757376&partnerID=40&md5=2bc1d716e1013721bdccb033bf44d034

DOI: 10.1109/FIE.2016.7757376

AFFILIATIONS: Educational Studies, Purdue University, West Lafayette, IN, United States;

School of Engineering Education, Purdue University, West Lafayette, IN, United States;

School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States

ABSTRACT: Highly technical STEM MOOCs have recently become widely available, but little is known about the motivations of the various groups of learners participating. In this work, we perform a detailed survey of 1,624 learners to examine their motivations in detail. These learners exhibited overall high levels of intrinsic motivation, but varied in their extrinsic motivation, according to their current position as students, workers, or unemployed individuals. Students generally reported the highest levels of extrinsic motivation compared to other groups (p<0.001). The results from this analysis indicate that additional factors about learners in each group, such as their course participation and performance, should be examined in future work to help better understand the various needs of those enrolling in highly technical STEM MOOCs. © 2016 IEEE.

AUTHOR KEYWORDS: Learners; MOOCs; Motivation

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Figueira, A.

Predicting grades by principal component analysis: A data mining approach to learning analyics

(2016) Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016, art. no. 7757025, pp. 465-467.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006886568&doi=10.1109%2fICALT.2016.103&partnerID=40&md5=168c53de74e51a103d62f0a0bd51c3aa

DOI: 10.1109/ICALT.2016.103

AFFILIATIONS: CRACS / INESCT TEC and University of Porto, Rua do Campo Alegre, Porto, Portugal

ABSTRACT: In this paper we introduce three main features extracted from Moodle logs in order to be uses a possible means to predict future student grades. We discuss the statistical analysis on these features and show how they cannot be applied isolatedly to model our data. We then apply them as a whole and use principal component analysis to derive a decision tree based on the features. With derived tree we are able to predict grades in three intervals, namely to predict failures. Our proposed analysis methodology can be incorporated in an LMS and be used during a course. As the course unfolds, the system can to trigger alarms regarding possible failure situations. © 2016 IEEE.

AUTHOR KEYWORDS: Data mining; Decision tree; Feature selection; Grade prediction; Moodle logs

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Cotts, E., Fang, J., Jones, W., Klotzkin, D., Myers, G., White, B.

A STEM program focused on transfer student success at Binghamton university

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757551, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006725509&doi=10.1109%2fFIE.2016.7757551&partnerID=40&md5=f17b090fc612c4a0953f363a9f03d5d2

DOI: 10.1109/FIE.2016.7757551

AFFILIATIONS: Binghamton University, Binghamton, NY, United States

ABSTRACT: Some transfer students have significant challenges in adapting to the pace and depth of a competitive four-year University. According to the National Student Clearinghouse Research Center, only 60% of transfer students from community colleges have earned their baccalaureate degree four years after transferring. In this paper, we present our program designed to increase the success rate of transfer students. Our goal is to continue Binghamton University's tradition of providing an effective collegiate learning environment for all, and particularly, to increase the success rate of the transfer students in STEM fields. © 2016 IEEE.

AUTHOR KEYWORDS: Community colleges; STEM; Transfer students

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Cohen, B.

Teaching STEM after school: Correlates of instructional comfort

(2016) Journal of Educational Research, pp. 1-10. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84999648440&doi=10.1080%2f00220671.2016.1253537&partnerID=40&md5=98c47fde746dfeae1be1409c558c959f

DOI: 10.1080/00220671.2016.1253537

AFFILIATIONS: Center for Schools and Communities, Camp Hill, Pennsylvania, USA

ABSTRACT: Science, technology, engineering and mathematics (STEM) education is a critical component of federal policymakers' agendas. Out-of-school time (OST) programs are designated as an important venue to teach STEM to K–12 students. Using a sample of OST direct staff in Pennsylvania (n = 133), the present analysis examines instructional methods used for STEM lessons and then explores the comfort level that staff have teaching STEM. About 20% or more of staff are not comfortable teaching STEM, depending on the subject. Multivariate analyses (Mann-Whitney tests) also show that staff with fewer STEM credentials, and who work in less-networked programs, or programs with less STEM instruction overall, are more likely to express discomfort teaching STEM. Policy and planning implications are discussed. © 2016 Center for Schools and Communities/CSIU

AUTHOR KEYWORDS: Afterschool; instruction; STEM; teachers; teaching

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Carrico, C., Murzi, H., Matusovich, H.

The roles of socializers in career choice decisions for high school students in rural central Appalachia: "Who's doing what?"

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757722, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006825708&doi=10.1109%2fFIE.2016.7757722&partnerID=40&md5=398de893ec6890070726332b07a517c7

DOI: 10.1109/FIE.2016.7757722

AFFILIATIONS: Department of Engineering Education, Virginia Polytechnic Institute and State University, Blacksburg, VA, United States

ABSTRACT: Students from low social economic status (SES) groups remain underrepresented in higher education and particularly in STEM fields. From existing literature, we know some of the barriers in promoting STEM careers among people in low SES groups include a lack of role models, understanding or misconceptions of STEM careers, and knowing about STEM career opportunities. The purpose of our research is to explore the potential influence of socializers on students as they make career choice decisions (primarily in science and engineering) from student's and educator's perspectives. We focused on students from Appalachia because they typically come from lower SES, are often first generation college (FGC) students, and are underrepresented in STEM fields, making their college and career choices particularly important to understand. We framed our research in Eccles' Expectancy Value Theory using data from an on-line informational questionnaire with educational stakeholders and in-person interviews with high school students from rural central Appalachia. Consistent with EVT, our findings reveal that students consider their parents and their educators as valuable socializers. Educators, however, value outreach activities provided by professionals to help students explore engineering career choices. This is consistent with a reported lack of confidence in ability to talk with students regarding engineering careers. By comparing the perspectives of students and educators, we begin to address the potential gaps of "who's doing what" with respect to assisting students as they navigate career choice decision making in high school. © 2016 IEEE.

AUTHOR KEYWORDS: Career choice; Motivation; Rural Central Appalachia; Socializers

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Ruipérez-Valiente, J.A.a b , Muñoz-Merino, P.J.a , Kloos, C.D.a

An analysis of the use of badges in an educational experiment

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757424, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006802875&doi=10.1109%2fFIE.2016.7757424&partnerID=40&md5=d97aa8fd716b439c202954db628fb2bf

DOI: 10.1109/FIE.2016.7757424

AFFILIATIONS: Universidad Carlos III de Madrid, Av. Universidad, 30, Leganés, Spain;

IMDEA Networks Institute, Av. del Mar Mediterráneo 22, Leganés, Spain

ABSTRACT: The use of badges in educational contexts its starting to gain popularity. However many studies do not offer an extensive analysis of the results regarding the use of badges after the educational experiment is finished. In this work we offer an evaluation of the results of three courses (physics, chemistry and mathematics) that we have conducted using Khan Academy with a wide badge system and 291 different students. We analyze these results regarding the distribution of badges per student, analyzing also the different badge types and which of them were delivered more often. We also explore the influence of factors such as the difficulty of problems or video length in the amount of badges triggered by exercises and videos respectively. We compare the results among the three courses trying to find possible explanations to these differences. We also put the lessons learned into context and give recommendations so that our findings can be used by instructional designers and other researchers. © 2016 IEEE.

AUTHOR KEYWORDS: Analytics; Badges; Distance learning; Khan Academy

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Merino, P.P.a , Ruiz, E.S.b , Fernandez, G.C.b , Gil, M.C.b

Robotic Educational Tool to engage students on Engineering

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757417, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006804233&doi=10.1109%2fFIE.2016.7757417&partnerID=40&md5=7d0a515b122fe636de7b4369935c5584

DOI: 10.1109/FIE.2016.7757417

AFFILIATIONS: HW R and D, WESTRACE SE, Siemens Rail Automation, SAU, Tres Cantos, Spain;

Electrical and Computer Engineering Department, Spanish University for Distance Education (UNED), Madrid, Spain

ABSTRACT: The aim of this paper is to summarize the Work in Progress related to the design of a Collaborative Robotic Educational Tool. This tool arises to improve STEM (Science, Technology, Engineering and Math) educational programs for school students. The design is intended to cover different specifications such as: scalability, modular capabilities, reconfiguration possibilities and compatibility with the aim of promoting the innovation and the motivation of the students during the learning process. Furthermore, the main objective of the mentioned platform is focused on getting a cost effective tool which can be included easily within educational institutions with a low budget restriction. This platform is intended for students which are able to use textual programming languages. Furthermore, the platform is expected to cost below 100 euros. © 2016 IEEE.

AUTHOR KEYWORDS: Arduino; Education; FPGA; IoT; Raspberry Pi; Robotics; STEM

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Abid, A.a , Kalle, I.a b , Ben Ayed, M.a c

Teamwork construction in E-learning system: A systematic literature review

(2016) 2016 15th International Conference on Information Technology Based Higher Education and Training, ITHET 2016, art. no. 7760756, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007292072&doi=10.1109%2fITHET.2016.7760756&partnerID=40&md5=904c01a108a550774369a8b087e11697

DOI: 10.1109/ITHET.2016.7760756

AFFILIATIONS: REGIM-Lab: Research Groups in Intelligent Machines, University of Sfax, ENIS, BP 1173, Sfax, Tunisia;

ISIMS: Higher Institute of Computer Science and Multimedia of Sfax, Route de Tunis Km 10 B.P. 242, Sfax, Tunisia;

Faculty of Sciences of Sfax, Computer Science and Communications Department, Route Sokra Km 3.5 BP 11713000, Sfax, Tunisia

ABSTRACT: With the increasing diversity of learners, forming suitable learning groups, in collaborative learning, represents a complex and a time-consuming task. Several researchers focus on the theory of teamwork organizations, based on academic performances, learning styles, learning settings, gender, etc. Therefore, grouping learners based on their predicted academic performance level in each subject separately may be more effective in a collaborative learning environment, but it still a challenging subject. First of all, we present in this paper a systematic literature review (SLR) to identify the relevant studies that address the problem of predicting academic performance and to extract the used data mining methods such as Decision Tree, Naïve Bayes, Neural Network, Support Vector Machine, etc. At the beginning, a set of 658 papers were selected. After applying the different SLR's steps, this selection has been filtered to 12 papers using specific selection criteria and a careful analysis of each paper. Then, the selected studies were used to answer the defined research questions. Finally, synthesis data, current research gaps and recommendations for further work are discussed in this paper. © 2016 IEEE.

AUTHOR KEYWORDS: Collaborative learning; Data mining; E-learning; Systematic literature review; Teamwork

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Proceedings - Frontiers in Education Conference, FIE

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, 2736 p.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006741845&partnerID=40&md5=9ee80770761c71e9acb77d95c35295d9

ABSTRACT: The proceedings contain 395 papers. The topics discussed include: a developmental and adaptive problem based learning (PBL) model across the curriculum: from theory to practice in integrating and assessing PBL experiences across the James Madison university engineering curriculum; integrated faculty course assessment report (FCAR) model with traditional rubric-based (gr) model to enhance automation of student outcomes evaluation; business & engineering education: a multiple stakeholder perspective; an adaptive e-learning platform for the qualification for working on electric vehicles; knowledge transfer: does more experience yield improved design quality?; using gamification for engagement and learning in electrical and computer engineering classrooms; mobile serious game proposal for environmental awareness of children; a framework to teach middle school students mathematics and science using robots; towards the stem knowledge homogenization of pre-university students in 21st century: MOOC: the language for engineering; using spaced repetition and gamification to enhance K-12 student science literacy with on-demand mobile short reads; broadening and sustaining an air quality K-12 curriculum through a digital library and undergraduate service learning course; and a modular approach to teaching critical infrastructure protection concepts to engineering, technology and computing students.

DOCUMENT TYPE: Conference Review

SOURCE: Scopus

Wu, Y., De Vries, C., Onipede, O., Ford, M.

Enhance hands on experience of system and control using low cost LEGO kits

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757671, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006717002&doi=10.1109%2fFIE.2016.7757671&partnerID=40&md5=c85e24fcc6596faf0e49a4050cf191bf

DOI: 10.1109/FIE.2016.7757671

AFFILIATIONS: Pennsylvania State University Erie, Behrend College, Erie, PA, United States

ABSTRACT: System Dynamics is a required coursed offered to junior Mechanical Engineering students at Pennsylvania State University Erie, the Behrend College. It addresses the intercoupling dynamics of a wide range of dynamic systems: mechanical, electrical, fluid, hydraulic, electromechanical, biomedical, etc. It is a challenging course due to the abstract nature and increased mathematics needed to understand the topic. While hands-on experience can be a useful tool in learning the material, the ready to use units in the market are costly. This paper explores the applications of using low cost LEGO® MINDSTORMS® NXT kits to add hands-on experience for an undergraduate Systems Dynamics course. The labs include (1) time response of a first order system and transfer function identification and verification, (2) time response of a second order system, and (3) PD controller design. These lab activities use MATLAB®/Simulink® to study the response of LEGO MINDSTORMS units. Technical surveys before and after each lab have been analyzed and show that there is an improvement in students' confidence in topics from system dynamics with the labs. These three lab activities will evolve into two 2-hour labs of a one-credit lab course, Dynamics and Vibration, to be offered in Fall 2016. This lab course will complement the current courses in dynamics and vibration, attracting mechanical engineering students to pursue future careers in the field of dynamics and controls. © 2016 IEEE.

AUTHOR KEYWORDS: Hand on experience; Systems Dynamics; Undergraduate education

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Desmond, D., Horton, M., Morrison, A., Khorbotly, S.

Robotic football dance team: An engineering Fine-Arts interdisciplinary learning experience

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757485, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006790217&doi=10.1109%2fFIE.2016.7757485&partnerID=40&md5=79a03bba324418b4d7c609e8eb6b50e8

DOI: 10.1109/FIE.2016.7757485

AFFILIATIONS: Department of Electrical and Computer Engineering, Valparaiso University, Valparaiso, IN, United States

ABSTRACT: With the increasing focus on the importance of interdisciplinary projects in the academic setting, it still seems as if most of these projects are either collaborations between disciplines in the STEM fields or collaborations between disciplines in the Liberal Arts fields. Despite the fact that they complement each other, a significant barrier still exists between STEM and Liberal Arts students. This paper describes the joint work of three Electrical and Computer Engineering students with one Fine-Arts student on an extracurricular project. In preparation for the robotic football competition, a team of our Engineering students decided to create a robotic dance team to complement the football playing robots. In order to create this team, Engineering students assembled, calibrated, and programmed a team of ten robots. Multiple Fine-Arts student were recruited but only one joined the team to help with the music selection/creation and other aesthetic aspects of the robots. The interdisciplinary nature of the collaboration highlighted the need to knock down some of the barriers between the technical and Fine-Arts disciplines. The team dynamics showed that students from different disciplines need to get out of their respective comfort zones and collaborate for the sake of their projects. The paper includes a full description of the project and a review of the lessons learned from the collaboration. © 2016 IEEE.

AUTHOR KEYWORDS: Collaboration; Engineering; Fine-arts; Interdisciplinary; Robots; Teamwork

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Conklin, N.B.a , Lee, W.b

A sub-orbital experimental payload for engaging undergraduate engineering students in interdisciplinary research

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757632, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006759569&doi=10.1109%2fFIE.2016.7757632&partnerID=40&md5=ac480ca472b6b68aa05f27c64efee41a

DOI: 10.1109/FIE.2016.7757632

AFFILIATIONS: Department of Physics, Gannon University, Erie, PA, United States;

Department of Electrical and Computer Engineering, Gannon University, Erie, PA, United States

ABSTRACT: By participating in NASA's Undergraduate Student Instrumentation Project (USIP), faculty members from physics and electrical and computer engineering (ECE) mentored 21 students in extracurricular undergraduate research ranging from freshman through seniors, predominantly from the ECE department, but also from other departments in science and engineering. In this paper, we present technical details to complete an experimental payload for sub-orbital exploration under NASA?s USIP as well as analysis of post-flight survey results for its effect on student learning experience. The USIP program was created by NASA to engage and educate interdisciplinary teams of undergraduate students by providing student-designed payloads access to sub-orbital vehicles. Undergraduates take primary responsibility for all aspects of the project, gaining valuable project management experience; preparing for technical reviews; finalizing project design; and completing payload construction, testing, and integration to ensure a successful flight. A post-flight survey was conducted to assess student learning outcomes and demonstrated that students found participation in USIP to be a valuable use of their time that increased their interest in pursuing a career in science, technology, engineering and/or mathematics. The project also provided an opportunity for students to further the learning objectives that are typically assessed in the a-k student outcomes required for ABET accreditation. © 2016 IEEE.

AUTHOR KEYWORDS: ABET student outcomes; High-altitude ballooning; Interdisciplinary research; Near-space exploration; Undergraduate research

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

De Oliveira Brandão, L.a , Bosse, Y.b , Gerosa, M.A.a

Visual programming and automatic evaluation of exercises: An experience with a STEM course

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757621, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006761843&doi=10.1109%2fFIE.2016.7757621&partnerID=40&md5=ea16d5b6efc8fee56e59c579067e7575

DOI: 10.1109/FIE.2016.7757621

AFFILIATIONS: Institute of Mathematics and Statistics, University of São Paulo, USP, São Paulo, Brazil;

Department of Computing, Federal Univ. of Mato Grosso Do sul, UFMS, Ponta Porã, Brazil

ABSTRACT: Programming capabilities are important to the new professionals. Although several initiatives all over the world haves been proposed for teaching programming to people at all levels. Many undergraduate students still fail in the programming courses. Proposed strategies have included visual programming and automatic evaluation of exercises. Nevertheless, there is still a lack of knowledge about students' perceived difficulties in using these strategies in practice: that is, their challenges to learning how to program. In this paper, we report a study aimed at understanding these difficulties and strategies in a STEM course. We used an environment comprising a visual programming tool to introduce algorithms, iVProg with iAssign, and the virtual programming lab (VPL) to introduce programming in C, both with automatic assessment integrated to Moodle. We report quantitative and qualitative results and future directions. Teachers and tool designers can leverage these results to better support programming learning. © 2016 IEEE.

AUTHOR KEYWORDS: Automatic evaluation; Difficulty; Learning; Novice; Programming

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Tomkin, J.a , West, M.b , Herman, G.L.b

A methodological refinement for studying the STEM grade-point penalty

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757646, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006801924&doi=10.1109%2fFIE.2016.7757646&partnerID=40&md5=35baa13d25b255985e48d9cdb812359f

DOI: 10.1109/FIE.2016.7757646

AFFILIATIONS: University of Illinois at Urbana-Champaign, Champaign, IL, United States;

University of Illinois at Urbana-Champaign, Urbana, IL, United States

ABSTRACT: We present a study that explores the grade-point average (GPA) penalties that students face when taking introductory STEM courses. Previous work has found that there is a large and significant grade point penalty for women and minorities in most STEM classes (that is, these students perform worse in these classes than their overall GPA would suggest). We recreated this work using a new, large data set (63,012 students over 10 years) of student performance, and found that the initial results held when using the original approach. We argue that there are methodological shortcomings to the original approach, however, as there is no attempt to control for individual student program difficulty (STEM majors and non-STEM majors share some classes, but have very different overall suites of courses that determine their overall GPA). As the female/male and racial ratios vary across majors it is therefore likely that a division by gender is not comparing equivalent sample populations. By controlling for student test scores or major most of the penalty is removed. The initial findings of large GPA penalties in STEM courses appears to be an example of "Simpson's Paradox". © 2016 IEEE.

AUTHOR KEYWORDS: Engineering; Gender; Grade point penalty; Race

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Zeid, A.a , Bogard, M.b , Javdekar, C.c , Duggan, C.d

Formative evaluation of an innovative program to prepare non-technical majors to join advanced manufacturing workforce

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757549, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006826305&doi=10.1109%2fFIE.2016.7757549&partnerID=40&md5=201d476d94cbbee11a0b2225cfaafe82

DOI: 10.1109/FIE.2016.7757549

AFFILIATIONS: MIE Dept, Northeastern University, Boston, MA, United States;

Eng. Dept, MassBay Community College, Wellesley Hills, MA, United States;

STEM Division, MassBay Community College, Wellesley Hills, MA, United States;

STEM Center, Northeastern University, Boston, MA, United States

ABSTRACT: The manufacturing industry has been thriving recently after decades of defection offshore and outsourcing. The manufacturing industry in the state of Massachusetts is particularly strong. Massachusetts and other US states report shortage of enough skilled workforce to fill advanced manufacturing positions such as robotics operators, programmers, CNC programmers, CAD operators, and QA personnel, to name a few. The labor shortage is attributed to the lack of STEM pipeline of students who are interested to pursue STEM careers including manufacturing. This paper describes an innovative approach of how to re-train non-technical majors (liberal arts graduates) for a second career to join the manufacturing workforce. The paper focuses on the formative evaluation of the approach. It covers the evaluation instruments including survey forms, data collection, data analysis, and insightful conclusions. The formative evaluation is conducted by a professional external evaluation organization and administered to the first cohort in a three-year NSF funded program. © 2016 IEEE.

AUTHOR KEYWORDS: Advanced manufacturing; Formative evaluation; Second career; Workforce labor needs

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Chen, Y.-H.a , Tau, A.a , Zastavker, Y.V.a , Stolk, J.D.a , Dillon, A.a , Gross, M.D.b

Understanding students' perception of academic and professional relevance in STEM courses

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757462, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006744095&doi=10.1109%2fFIE.2016.7757462&partnerID=40&md5=2c3efb94eab77d349f03f928a401351b

DOI: 10.1109/FIE.2016.7757462

AFFILIATIONS: Franklin W. Olin College of Engineering, Needham, MA, United States;

Wake Forest University, Winston-Salem, NC, United States

ABSTRACT: In this Work-in-Progress paper we examine students' situational motivation in introductory STEM courses through analysis of survey responses about students' experiences in a required course at each of two large public institutions. The students in each course convey different perceptions of course relevance: learning-performance relevance and temporal relevance. Learning-performance relevance, exclusive to Course A, refers to students' perceptions of course content and activities as relevant to their performance, which in turn serve as necessary prerequisites for achieving future academic and professional goals. Temporal relevance, described primarily by students in Course B, pertains to students' non-performance-based perceptions of course content as applicable to their long-term academic and professional careers, as well as their personal intellectual growth. We posit that understanding the ways in which students perceive the relevance of course assessments, content, and activities to their near-and long-term future aspirations may allow for improved instructor support of intrinsic motivational attitudes in STEM classrooms. © 2016 IEEE.

AUTHOR KEYWORDS: Examination-driven perceptions; Introductory STEM courses; Motivation; Performance; Relevance

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Lee, W.a , Conklin, N.B.b

Improving student learning experience via extracurricular undergraduate research in near-space ballooning

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757631, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006797947&doi=10.1109%2fFIE.2016.7757631&partnerID=40&md5=0a56c0b08cc6d2a5599d64577c3becb9

DOI: 10.1109/FIE.2016.7757631

AFFILIATIONS: Dept. of Electrical and Computer Engineering, Gannon University, Erie, PA, United States;

Dept. of Physics, Gannon University, Erie, PA, United States

ABSTRACT: This paper describes an on-going near-space, high-altitude ballooning program at Gannon, aimed for improving student learning experience via undergraduate research. Through team members' laboratory-based extracurricular activities in a complete cycle of an engineering design, our program is also intended to contribute to the development of the STEM workforce, particularly in electrical and computer engineering. Initially beginning with a high-altitude weather ballooning project with 10 senior undergraduate students in AY 2009-10, this program offered STEM students various opportunities to participate in payload design projects such as High Altitude Radiation Detector (HARD) Payloads #1, #2, and #3, as well as an Undergraduate Student Instrument Project (USIP) 2013 payload. The current student-faculty team is developing several high-altitude ballooning payloads for both the HASP 2017 campaign and the 2017 Eclipse Ballooning Project. We further present assessment results that demonstrate the programmatic success and the effectiveness of our program in improving the student learning experience and also in the development of the STEM workforce through high-altitude ballooning. © 2016 IEEE.

AUTHOR KEYWORDS: High altitude ballooning; Student learning experience; Undergraduate research

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Carvalho, J.R.H., De Oliveira, E.H.T., Carvalho, I.A.V.A.

STEM education program evaluation survey: A report of experience

(2016) Proceedings - Frontiers in Education Conference, FIE, 2016-November, art. no. 7757392, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006710897&doi=10.1109%2fFIE.2016.7757392&partnerID=40&md5=1034e4ad95f271e29a5fd4f7114f594f

DOI: 10.1109/FIE.2016.7757392

AFFILIATIONS: Institute of Computing, Federal University of Amazonas, Manaus, Brazil

ABSTRACT: Manaus, the capital of Brazilian Amazon state demands a rapid increase in the number of highly qualified professionals, mostly for its Industrial Pole. Hardware and software development for the consumer electronics and telecommunication sectors are the most challenging areas, due to the amount of open positions contrasting with the quality of local educational Institutions. To address this issue a local higher education organization (Institute of Computing of the Federal University of Amazonas) started, in partnership with Samsung da Amazonia Ltd. (the local subsidiary of the Korean conglomerate), a large scale program based on the so called multiple vortices, and comprising of set of involving activities, including training in classroom, and enrolling students in initiation or graduate projects. After three year of running program, the authors proposed a survey to verify the results achieved so far, more specifically on those two mentioned activities. The survey is designed to answer two questions: A) How mature is the participant in understanding his career; B) How is the participant's perception of the program efficiency in meeting his expectations. The survey is composed by 41 yes/no questions covering five different topics: 1) Perception about career and marked demands; 2) Information about the program purpose and objectives; 3) Changes in the career plan and expectations of the future; 4) Perceived relevance of the program; 5) Strength and weaknesses of the running program. Anti-redundant questions (i.e. two answers leads the same conclusion when one is yes and the other is no) were used to reduce bias and to assign a confidence level to the respondent, afterwards used to weight the student's contribution to the final statistics. The survey was applied to current and former program participants. The paper will detail the results, and the corrective actions suggested by the students' answers. Furthermore, the survey itself, the design and application methodology, which was based on a pilot group of students, will be part of the results presented in this paper. © 2016 IEEE.

AUTHOR KEYWORDS: Formatting; Insert; Style; Styling

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Munns, A.

A study of competence in mathematics and mechanics in an engineering curriculum

(2016) European Journal of Engineering Education, pp. 1-14. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84996490624&doi=10.1080%2f03043797.2016.1259292&partnerID=40&md5=1843ea32f607e85778397b8fe73578cc

DOI: 10.1080/03043797.2016.1259292

AFFILIATIONS: School of Science and Engineering, University of Dundee, Dundee, UK

ABSTRACT: Professional bodies expect engineers to show competence in both mathematics and engineering topics such as mechanics, using their abilities in both of these to solve problems. Yet within engineering programmes there is a phenomenon known as ‘The Mathematics Problem’, with students not demonstrating understanding of the subject. This paper will suggest that students are constructing different concept images in engineering and mathematics, based on their perception of either the use or exchange-value for the topics. Using a mixed methods approach, the paper compares 10 different types of concept image constructed by students, which suggests that familiar procedural images are preferred in mathematics. In contrast strategic and conceptual images develop for mechanics throughout the years of the programme, implying that different forms of competence are being constructed by students between the two subjects. The paper argues that this difference is attributed to the perceived use-value of mechanics in the career of the engineer, compared to the exchange-value associated with mathematics. Questions are raised about the relevance of current definitions of competence given that some routine mathematical operations previously performed by engineers are now being replaced by technology, in the new world of work. © 2016 SEFI

AUTHOR KEYWORDS: Competence; concept image; engineering; knowledge types; mathematics

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Mendonca, J., Goncalves, G., Ferro, T., Ferreira, M.

Teaching and learning of contents from numerical methods using the technology: Comparison of the use of two technological resources

(2016) 2016 International Symposium on Computers in Education, SIIE 2016: Learning Analytics Technologies, art. no. 7751823, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006789906&doi=10.1109%2fSIIE.2016.7751823&partnerID=40&md5=1e0c124759e1de7617cdceb044a3b4de

DOI: 10.1109/SIIE.2016.7751823

AFFILIATIONS: Instituto Superior de Engenharia Do Porto, Departamento de Matemática, Porto, Portugal

ABSTRACT: In this paper we compare the methodology using the Excel software used in the academic year 2014-15 with the methodology using the Java in the academic year 2013-14. These were taken to teaching content of the course of Numerical Methods (METNU) Systems Engineering Degree from the College of Engineering of Porto Institute. In terms of results Excel software appears as a good alternative to Java. © 2016 IEEE.

AUTHOR KEYWORDS: Excel; Mathematics Teaching; Numerical methods; technological resources

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Ataucusi, P.E.a , Espinoza, N.R.a , Taype, M.a , Ataucusi, E.b , Ibarra, M.J.c

Yachay math: Learning fractions with spatio-temporal approach, using computer animation

(2016) Proceedings - 2016 11th Latin American Conference on Learning Objects and Technology, LACLO 2016, art. no. 7751799, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006943990&doi=10.1109%2fLACLO.2016.7751799&partnerID=40&md5=65dffe8d2e75bf10f5f2dc9a8e6dce4a

DOI: 10.1109/LACLO.2016.7751799

AFFILIATIONS: Colegio de Alto Rendimiento, Aymaraes. Apurímac, Peru;

II.EE Francisco Bolognesi, Abancay, Peru;

Escuela Acad. Prof. Ing. Informática y Sistemas, Universidad Nacional Micaela Bastidas de Apurímac, Apurímac, Peru

ABSTRACT: To improve the learning process in mathematics, new approaches are needed. Yachay Math is visual and interactive software that has been developed to use on desktop computers, tablets and mobile devices. It is a tool for spatio-temporal reasoning, designed for students to learn mathematical concepts dynamically. Yachay Math provides to teachers a visual approach for mathematics teaching and for the students is a new way to learn fractions without text instructions, so the focus is to solve problems by students discovering. The tool was tested and validated by students and teachers from three rural schools in Apurimac-Peru. Two types of tests were performed; the first one was by using the C-Means Fuzzy methodology and the second one by the user's opinion. The results show that teachers and students consider that Yachay Math is a funny way to learn fractions in mathematics. © 2016 IEEE.

AUTHOR KEYWORDS: Animación por Ordenador; Animación Visual Interactiva; Fracciones; Razonamiento Espacio-Temporal; Razonamiento Innato del Cerebro

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Pereira, A.B.C.a , Correa Da Silva, F.S.a , Bertholo Piconez, S.C.b

Mathematics experiences: Pedagogical implications with the use of digital games, m-learning and social networks

(2016) Proceedings - 2016 11th Latin American Conference on Learning Objects and Technology, LACLO 2016, art. no. 7751757, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006857146&doi=10.1109%2fLACLO.2016.7751757&partnerID=40&md5=8d7a1255dcff7aea17ee4fab14537202

DOI: 10.1109/LACLO.2016.7751757

AFFILIATIONS: Dept. of Computer Science, IME-USP, São Paulo, Brazil;

Dept. of Education, FE-USP, São Paulo, Brazil

ABSTRACT: This paper treats PhD. Thesis results about pedagogical implications of using digital games and social networks in mobile devices on the Bring Your Own Device perspective for mathematics learning at a state elementary school. This work has shaped by Feuerstein beliefs about learning and whose theories ground her practices. This work used dialogical process to influence students and teachers in learning and teaching, and action research as methodology. The cognitive skills development were far beyond the expectations of the initial hypothesis. The digital games proved himself as an auxiliary support for the teachers on the overcoming of the students demotivation in order to develop fundamental competences presents on the scholar curriculum content. © 2016 IEEE.

AUTHOR KEYWORDS: Digital-game based learning; Mobile and Personal Device; Mobile learning; Social Networking

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Munoz-Soto, R.a b , Becerra, C.a , Noël, R.a , Barcelos, T.c , Villarroel, R.b , Kreisel, S.a , Camblor, M.a

Proyect@ matemáticas: A learning object for supporting the practitioners in autism spectrum disorders

(2016) Proceedings - 2016 11th Latin American Conference on Learning Objects and Technology, LACLO 2016, art. no. 7751760, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006942602&doi=10.1109%2fLACLO.2016.7751760&partnerID=40&md5=8e3918fad52d21bfa8c5d5af1bf7c1a6

DOI: 10.1109/LACLO.2016.7751760

AFFILIATIONS: Universidad de Valparaíso, Chile;

Pontificia Universidad Católica de Valparaíso, Chile;

Instituto Federal de Educação, Ciěncia e Tecnologia de São Paulo, Brazil

ABSTRACT: Autism Spectrum Disorder is the name of a group of neurodevelopmental disorders which affect social skills that should be developed at an early age. For this reason, they may hinder the development of other basic skills such as the cognitive ones related to logical and mathematical thinking. The development of these skills is a primary goal for special education initiatives on a permanent basis as they allow the acquisition of knowledge that is used in everyday life. These skills may also facilitate social inclusion and a future insertion in the labor market. In Chile there are no Learning Objects available that potentiate the development of mathematical skills in children with Autism Spectrum Disorder. For this reason, a Learning Object for multi-touch devices was developed in order to support therapeutic and co-therapeutic initiatives for the development of math skills in children with Autism Spectrum Disorder. The Learning Object is currently available at Google Play and had more than 15,000 downloads. © 2016 IEEE.

AUTHOR KEYWORDS: Autism Spectrum Disorders; Learning Object; Mathematics; Multitouch Application

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Nieto, S., Ramos, H.

Constructing extended Boolean functions from truth tables using the Mathematica system

(2016) 2016 International Symposium on Computers in Education, SIIE 2016: Learning Analytics Technologies, art. no. 7751828, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006804597&doi=10.1109%2fSIIE.2016.7751828&partnerID=40&md5=eed0d4e8cf8d761edeea5a9ab0344cf1

DOI: 10.1109/SIIE.2016.7751828

AFFILIATIONS: Applied Mathematics Dpt., Institute of Educational Sciences, Polytechnic School of Zamora, University of Salamanca, Salamanca, Spain

ABSTRACT: Truth Tables are a basic tool in the analysis of compound propositions within the field of propositional logic. However, its usefulness extends beyond, covering aspects of Boolean logic, circuit theory, the Algebra of Sets or systems analysis. The symbolic computational system Mathematica has numerous commands for working with propositions, calculate their truth values and get Boolean functions associated with truth tables, but the result is always presented in the simplest possible form. This simplification, although undoubtedly useful, it is not the most appropriate from the educational point of view. We present a specific modification of the program in order to build gradually the Boolean functions from their truth values, expressing the result in the conjunctive or disjunctive normal forms before making any simplification. This contribution is made with the aim of helping students of Discrete Mathematics at the Computer Engineering degree to understand the process of construction of the Boolean functions, and autonomously check their progress in this discipline. © 2016 IEEE.

AUTHOR KEYWORDS: Boole Algebra; Mathematica system; Truth Tables

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Do Prado, R.T., Sirakawa, W.Y., Henrique Da Silva Arruda, J., Pacheco, B.A., Souza-Concilio, I.A.

Labirinto matemático a game to stimulate mathematical reasoning in children

(2016) Proceedings - 2016 11th Latin American Conference on Learning Objects and Technology, LACLO 2016, art. no. 7751776, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006857903&doi=10.1109%2fLACLO.2016.7751776&partnerID=40&md5=bd566a095fe415009f28fcf0c48e1fb8

DOI: 10.1109/LACLO.2016.7751776

AFFILIATIONS: Faculdade de Computação e Informática, Universidade Presbiteriana Mackenzie, São Paulo-SP, Brazil

ABSTRACT: In the past, computer games were only used for entertainment. Their use in the classroom was not even considered. Nowadays, there is an increasing number of educators interested in the effective and motivational aspects provided by digital games in order to engage students in the learning process. This paper presents Labirinto Matemático, a simple mobile game developed to improve and stimulate the mathematical reasoning in children. In this Learning Object, the children may resolve a simple addition or subtraction equation, find the ball with the correct result and manage the device to bring the correct ball to the center of a maze. © 2016 IEEE.

AUTHOR KEYWORDS: Games; Kids; Learning Objects; Mathematics

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

van Aalderen-Smeets, S.I., Walma van der Molen, J.H.

Modeling the relation between students’ implicit beliefs about their abilities and their educational STEM choices

(2016) International Journal of Technology and Design Education, pp. 1-27. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995803032&doi=10.1007%2fs10798-016-9387-7&partnerID=40&md5=c3415ca2879db9f0d9338753d0402779

DOI: 10.1007/s10798-016-9387-7

AFFILIATIONS: Center for Science Education and Talent Development, Faculty of Behavioral, Management, and Social Sciences, University of Twente, PO Box 217, Enschede, Netherlands

ABSTRACT: Despite the large body of research on students’ educational and career choices in the field of technology, design, and science, we still lack a clear understanding of how to stimulate more students to opt for a study path or career within the STEM fields (Science, Technology, Engineering, Mathematics). In this article, we outline a new theoretical framework to describe how students’ implicit belief about the malleability of their intelligence can be an important precursor of their STEM educational and career choice behavior. Based on the different bodies of literature about STEM choices and about students’ implicit beliefs about their abilities, we present three hypothetical pathways, in the form of testable models, that describe potential relations between the implicit theories that students may hold regarding the malleability of their STEM ability and students’ intentions to pursue a STEM career. Each pathway outlines a specific mediating factor influencing this relation: (a) self-efficacy beliefs, (b) stereotypical thinking, and (c) motivational beliefs. These pathways provide more insight into the underlying mechanisms that may affect STEM choice behavior. In our view, such a theoretical underpinning is a necessary prerequisite for further scientific investigation into the potential relations between students’ implicit beliefs about their potential development, relevant psychological variables, and STEM choice behavior. Furthermore, we believe it provides a theoretical foundation for practical interventions that aim to stimulate STEM choice behavior. © 2016 The Author(s)

AUTHOR KEYWORDS: Ability related beliefs; Educational and career choice; Implicit theories of intelligence; Mindset; STEM; STEM pipeline

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Han, S.W.

Standards-based external exams and students’ science-related career expectations: an international perspective

(2016) Educational Research and Evaluation, 22 (7-8), pp. 374-401.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84999808851&doi=10.1080%2f13803611.2016.1257946&partnerID=40&md5=8e2a72ad34af24cfd135d078750ca988

DOI: 10.1080/13803611.2016.1257946

AFFILIATIONS: Department of Educational Leadership and Policy, University at Buffalo, Buffalo, NY, United States

ABSTRACT: Students’ science-related career expectations are important for predicting their future science, technology, engineering, and mathematics (STEM)-related educational and occupational attainments. This study examines the degree to which standards-based external examinations are associated with a student’s propensity for pursuing science-related professional occupations. The science-related fields included in the analysis are mathematics, physical and life science, and engineering/computing. Three-level hierarchical generalized linear models are employed to analyse international survey and student achievement data from the Programme for International Student Assessment (PISA). The analyses show that students in national education systems that require standards-based external examinations have lower expectations for science-related professional careers than students in the systems that do not use such examinations. This negative association remained constant by gender as well as across levels of science performance. From an educational policy point of view, the results suggest the negative consequence of standards-based external exams in fostering students’ interests in pursuing science-related careers. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: international; PISA; science-related career expectations; Standards-based external exams

DOCUMENT TYPE: Article

SOURCE: Scopus

Funke, A., Berges, M., Hubwieser, P.

Different perceptions of computer science

(2016) Proceedings - 2016 International Conference on Learning and Teaching in Computing and Engineering, LaTiCE 2016, art. no. 7743145, pp. 14-18.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85002694057&doi=10.1109%2fLaTiCE.2016.1&partnerID=40&md5=b0fcdeb16c5833e8fc11eaf0ad081c0c

DOI: 10.1109/LaTiCE.2016.1

AFFILIATIONS: TUM School of Education, Technical University of Munich, Arcisstr. 21, Munich, Germany

ABSTRACT: This research project aims to investigate, how young men and women differ regarding (1) their perceptions of Computer Science (CS) as a scientific discipline respectively as a professional field and (2) the experiences that had influenced their choice of major subject. For that purpose, we conducted a biographical study of CS freshmen at university. In total, 217 students (54 female, 163 male) participated on the survey. The qualitative analysis showed that young men and women do have different viewpoints on computer science. While the male students tend to focus on technical aspects like hardware, mathematics, or logical issues, the female students are attracted rather by creativity, communication, or job opportunities. Furthermore, we investigated the differences between several courses of study. While students of core Computer Science are emphasizing technical issues and their personal experience with computers, the students of Games Engineering, Information Systems, or Bioinformatics mainly focus on the application fields and regard CS as a tool. All these differences seem to influence the selection of the major subject of the students. They might explain the problem of low enrollment rates in Computer Science and the decreasing number of students in core Computer Science in comparison to the more interdisciplinary courses of study. © 2016 IEEE.

AUTHOR KEYWORDS: Biographies; Computer Science Education; Gender Differences

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Spooner, K., Clear, T.

A foundation programme preparing students for future study in computing and engineering degrees

(2016) Proceedings - 2016 International Conference on Learning and Teaching in Computing and Engineering, LaTiCE 2016, art. no. 7743155, pp. 66-70.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85002528608&doi=10.1109%2fLaTiCE.2016.41&partnerID=40&md5=dbc4afc4dc2089fc209d286ac86ddb36

DOI: 10.1109/LaTiCE.2016.41

AFFILIATIONS: School of Engineering, Computer and Mathematical Sciences, Auckland University of Technology, Auckland, New Zealand

ABSTRACT: This paper presents the Certificate of Science and Technology (CertScT) a pre-degree programme at Auckland University of Technology in New Zealand, developed with the aim of preparing students to undertake degree level study in Science, Technology, Engineering and Mathematics (STEM) subjects. The history, context and rationale for the programme is outlined together with its structure and content, and pedagogical and programme level strategies that have been adopted to encourage student success. The authors reflect on the success of the programme to date in achieving its aims, based upon observation, reflections and data from internal evaluations of the programme. The paper notes the challenges for the programme posed by external metrics which the New Zealand Government has adopted. The paper concludes with a commentary on the success of the programme in achieving its goals, and the risks to its continuation. © 2016 IEEE.

AUTHOR KEYWORDS: Access; Certificate; Computing Education; Degree; Engineering Education; Equity; STEM Education

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Yadav, A.a , Alexander, V.b , Mehta, S.a

Case-based instruction in STEM: Analysis of student confidence

(2016) Proceedings - 2016 International Conference on Learning and Teaching in Computing and Engineering, LaTiCE 2016, art. no. 7743147, pp. 24-26.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85002721708&doi=10.1109%2fLaTiCE.2016.46&partnerID=40&md5=cd571d25dd5f0fab6870ad8f46bb34f1

DOI: 10.1109/LaTiCE.2016.46

AFFILIATIONS: Michigan State University, 620 Farm Lane, East Lansing, MI, United States;

#2 Cocoa Village, James Smart, Lower Manzanilla, Trinidad and Tobago

ABSTRACT: The use of case-based instruction in professional fields, such as law has been around since the late 1800s; however, the use of cases in engineering has only been around since the 1950s with their earliest implementation in Civil and Chemical engineering. Research on the implementation of case studies in engineering has mainly focused on student perception at the end of a course. There is limited research on students' perceptions of case studies as compared to traditional lecture approach. This paper presents results from a study that examined this relationship between students' perceptions and actual learning performance for lecture and case-based instruction. Specifically, we addressed the following research question: To what extent do students differ in their perceptions of their learning confidence and engagement connections across lecture and case-based instruction? We found that overall students found cases to be more engaging as compared to traditional lecture; however, in one case students found lecture to increase their learning more than cases. © 2016 IEEE.

AUTHOR KEYWORDS: Active learning; Case-based instruction; Engineering education I; Student perceptions

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Kanakaraddi, S.G., Naragund, J.G., Chikaraddi, A.K.

Connecting OOMD course to capstone project design

(2016) Proceedings - 2016 International Conference on Learning and Teaching in Computing and Engineering, LaTiCE 2016, art. no. 7743164, pp. 120-124.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85002923371&doi=10.1109%2fLaTiCE.2016.19&partnerID=40&md5=eb557a13fcc14ffed7a25da8defae5cc

DOI: 10.1109/LaTiCE.2016.19

AFFILIATIONS: B. V. B. College of Engineering and Technology, Vidyanagar, Karnataka, India

ABSTRACT: The professional courses like Engineering education evolves, based on the courses learnt in that four years duration. Computer Science and Engineering discipline comprises the core courses like mathematics, system, database, networks and programming language courses, etc according to ACM standards. The curriculum is designed in such a way that the core courses are related to each other in one or the other way. Since the related core courses are not handled by the same faculty in successive semesters because of instability of staff in the department of many Engineering Colleges, most of the time courses are taught in an isolated way. So the students are unable to correlate the core courses during their studies. Courses like the Mini and Capstone projects require the concept of core courses that time students are unable to use and correlate the concepts in carrying out these courses. This motivates the authors to select connectivity of courses as a topic to write this article. Object Oriented Modeling and Design course is focused on OO design techniques like Class model, State model, Interaction model and the students are studying this course in the final year. The authors conducted two pedagogy activities to model capstone project design through OOMD course. OO design techniques are explored using Unified Modeling Language constructs. First activity focuses on the model design manually and second designing activity is carried out using open source design tools like StarUML, E-Draw etc. to design their capstone project. Assignments considered in OOMD course are based on capstone project design. Using OO design concepts students are able to design system design, layered architecture and component designs for their capstone project and are also capable to provide alternative design solutions. These activities explore the students to use modeling concepts to develop real world applications involved in their project. © 2016 IEEE.

AUTHOR KEYWORDS: ACM standards; and E-Draw; OOMD; Smart draw; StarUML; UML

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Henderson, B.a , McKinney, R.A.b

Extended abstract: Catching the Hot Potato: Where does grammar land in STEM education

(2016) IEEE International Professional Communication Conference, 2016-November, art. no. 7740518, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85001975589&doi=10.1109%2fIPCC.2016.7740518&partnerID=40&md5=4b9b4e25821fe5830571ee3bf81e8310

DOI: 10.1109/IPCC.2016.7740518

AFFILIATIONS: University of California, Davis, CA, United States;

UNC School of Law, United States

ABSTRACT: The panel discussion, 'Catching the Hot Potato: Where Does Grammar Land in STEM Education,' brings together a forum of six subject matter experts, from different institutions and with differing points of view, to discuss grammar education for STEM students and professionals. The panelists will address grammar relevance, research, theories, and practices that relate to delivering grammar instruction in university classrooms, as well as through independent study and multi-media solutions. © 2016 IEEE.

AUTHOR KEYWORDS: Education; grammar; STEM; Technical writing

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Boettger, R.K.a , Wulff, S.b

Using authentic language data to teach discipline-specific writing patterns to STEM students

(2016) IEEE International Professional Communication Conference, 2016-November, art. no. 7740513, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85002373937&doi=10.1109%2fIPCC.2016.7740513&partnerID=40&md5=34af0848ab5d32c09d59aeab3d18dd06

DOI: 10.1109/IPCC.2016.7740513

AFFILIATIONS: University of North Texas, United States;

University of Florida, United States

ABSTRACT: Technical and scientific writing service courses offer instructors the opportunity to engage with student populations from across the university. However, it is also this interdisciplinary appeal that has complicated the quality of instruction, particularly for STEM majors. The heterogeneous student population in our service courses often results in generic instruction that contradicts how STEM practitioners communicate on the job. We offer corpus-linguistic approaches as a solution for teaching variation in writing classes. Engaging students with authentic language data helps them understand the patterns used in their discipline rather than reinforce general, and potentially prescriptive, writing principles. We focus our study on the presence of passive voice and reporting verbs in a corpus of student-written critical reviews and white papers. Our results indicated that students applied passive voice in both text types, contradicting the advice of most generalist technical writing textbooks. More importantly, students appeared to use passive voice with an intent, often as a way to stay on topic. Our results also demonstrated that students used a variety of reporting verbs, notably show, believe, and conclude. Overall, these findings suggest ways that technical and scientific writing instructors can integrate corpus research into their classrooms. © 2016 IEEE.

AUTHOR KEYWORDS: Corpus linguistics; passive voice; reporting verbs; scientific writing; Technical writing

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Park, D.-Y.a , Park, M.-H.b , Bates, A.B.a

Exploring Young Children’s Understanding About the Concept of Volume Through Engineering Design in a STEM Activity: A Case Study

(2016) International Journal of Science and Mathematics Education, pp. 1-20. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994201635&doi=10.1007%2fs10763-016-9776-0&partnerID=40&md5=8cccb4c8d06eef694fba85fd3e08ff7f

DOI: 10.1007/s10763-016-9776-0

AFFILIATIONS: School of Teaching and Learning, Illinois State University, Campus Box 5330, Normal, IL, United States;

Department of Early Childhood and Elementary Education, Murray State University, 3210 Alexander Hall, Murray, KY, United States

ABSTRACT: This case study explores young children’s understanding and application of the concept of volume through the practices of engineering design in a STEM activity. STEM stands for science, technology, engineering, and mathematics. However, engineering stands out as a challenging area to implement. In addition, most early engineering education research centers on curriculum and instruction rather than students’ understanding and application of models and content knowledge to a design project (Johri and Olds, Journal of Engineering Education, 100(1):151–185, 2011). For this study, we created a play-based STEM activity which helps students understand and apply the concept of volume in creating clay boats through the practices of engineering design. Three students voluntarily participated in this study. Data sources included interviews, photocopies of boats, and observation field notes which were analyzed using a comprehensive cross-case analysis. Findings indicate that the common pattern is rather intuitive when students define engineering problems using different criteria. Also, students’ solutions to engineering problems are associated with their experiential ideas of reality. How students express their understanding of volume is correlated to the way of their structuring volume. Lastly, students understand the concept of volume gradually while going through the practices of engineering design. Implications are discussed in terms of how engineering education contributes to students’ understanding of volume. © 2016 Ministry of Science and Technology, Taiwan

AUTHOR KEYWORDS: Engineering design; Engineering education; STEM; Volume; Young children

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Hernandez, P.R.a , Estrada, M.b , Woodcock, A.c , Schultz, P.W.c

Protégé Perceptions of High Mentorship Quality Depend on Shared Values More Than on Demographic Match

(2016) Journal of Experimental Education, pp. 1-19. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994682249&doi=10.1080%2f00220973.2016.1246405&partnerID=40&md5=ff0f44be69911a71d7bfb12a791921db

DOI: 10.1080/00220973.2016.1246405

AFFILIATIONS: Department of Learning Sciences and Human Development, West Virginia University, Morgantown, WV, USA;

Institute for Health Aging, University of California San Francisco, San Francisco, CA, USA;

Psychology Department, California State University San Marcos, San Marcos, CA, USA

ABSTRACT: Mentoring, particularly same-gender and same-race mentoring, is increasingly seen as a powerful method to attract and retain more women and racial minorities into science, technology, engineering, and mathematics (STEM) education and careers. This study examines elements of a mentoring dyad relationship (i.e., demographic and perceived similarity of values) that influenced the perceived quality of mentorship, as well as the effect of mentorship on STEM career commitment. A national sample of African American undergraduates majoring in STEM disciplines were surveyed in their senior year. Overall, perceived similarity, rather than demographic similarity of values, was the most important factor associated with protégé perceptions of high-quality mentorship, which in turn was associated with higher commitment to STEM careers. We discuss the implications for mentoring underrepresented students and broadening participation in STEM. 2017 © 2016 Taylor & Francis Group, LLC

AUTHOR KEYWORDS: Career commitment; college students; higher education; mentoring, minorities; perceived similarity; STEM

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Lambert, R., Sugita, T.

Increasing engagement of students with learning disabilities in mathematical problem-solving and discussion

(2016) Support for Learning, 31 (4), pp. 347-366.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85010916201&doi=10.1111%2f1467-9604.12142&partnerID=40&md5=f23147684c2dc128fb63cf92e4f21890

DOI: 10.1111/1467-9604.12142

ABSTRACT: Engagement in problem-solving and mathematical discussion is critical for learning mathematics. This research review describes a gap in the literature surrounding engagement of students with Learning Disabilities in standards-based mathematical classrooms. Taking a sociocultural view of engagement as participation in mathematical practices, this review found that students with LD were supported towards equal engagement in standards-based mathematics through multi-modal curriculum, consistent routines for problem-solving, and teachers trained in Mathematical Knowledge for Teaching. Using this small set of studies (7), we identify the need to deepen the engagement of students with LD in mathematical problem-solving and discussion. This review concludes with implications for teaching and learning. © 2017 NASEN

AUTHOR KEYWORDS: learning disabilities; Mathematical Knowledge for Teaching; mathematical practices; mathematics education; special education

DOCUMENT TYPE: Article

SOURCE: Scopus

Savelsbergh, E.R.a , Prins, G.T.a , Rietbergen, C.b , Fechner, S.a c , Vaessen, B.E.a d , Draijer, J.M.a , Bakker, A.a

Effects of innovative science and mathematics teaching on student attitudes and achievement: A meta-analytic study

(2016) Educational Research Review, 19, pp. 158-172.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84984832889&doi=10.1016%2fj.edurev.2016.07.003&partnerID=40&md5=a720296b28053ecce378d508a0f7f9b1

DOI: 10.1016/j.edurev.2016.07.003

AFFILIATIONS: Freudenthal Institute, Utrecht University, Netherlands;

Faculty of Social and Behavioral Science, Utrecht University, Netherlands;

University of Paderborn, Germany;

Eindhoven University of Technology, Netherlands

ABSTRACT: Many teaching approaches have been tried to improve student attitudes and achievement in science and mathematics education. Achievement effects have been synthesized, but a systematic overview of attitude effects is missing. This study provides a meta analytic review based on 56 publications (1988–2014), reporting 65 independent experiments that investigated the effects of teaching approaches on student attitudes in primary or secondary science or mathematics education. Five types of teaching approaches were distinguished: inquiry-based, context-based, computer-based, collaborative learning strategies, and extra-curricular activities. Since many different attitude outcomes were distinguished and attitudes were assessed at different levels of granularity, we did separate analyses for specific and more global outcomes. Outcomes were not significantly different for different educational approaches. When taking all interventions together, significant effects were found for General Attitude (n = 60; d = 0.35), General Interest (n = 20; d = 0.22), and Career Interest in Science (n = 4; d = 0.40). The effects were significantly weaker for studies with older students. Analysis of achievement outcomes yielded a significant and large overall effect (n = 40; d = 0.78), again with no significant differences between teaching approaches. Although the positive effects might be partly due to novelty, the current findings do counter skepticism about the learning outcomes of interest-oriented teaching approaches. © 2016 The Authors

AUTHOR KEYWORDS: Attitude; Interest; Mathematics education; Meta-analysis; Motivation; Science education; Teaching approach

DOCUMENT TYPE: Article

SOURCE: Scopus

Üstündağ, M.T.a , Yalçin, H.b , Güneş, E.c

Intellectual structure of stem education in educational research

(2016) Turkish Online Journal of Educational Technology, 2016 (NovemberSpecialIssue), pp. 1222-1230.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007189914&partnerID=40&md5=b03609ee982c6b3f8fd3aab6ca6867da

AFFILIATIONS: Gazi University, Gazi Faculty of Education, Computer Education and Instructional Technologies, Turkey;

İzmir Katip Çelebi University, Faculty of Humanities and Social Sciences, Information Management and Technologies, Turkey;

Ahi Evran University, Faculty of Education, Computer Education and Instructional Technologies, Turkey

ABSTRACT: The aim of this research is to put forward the intellectual structure of STEM (Science, Technology, Engineering and Mathematics) education concept in educational research. STEM education has emerged as a highly accepted paradigm in education especially in the USA and European countries in recent years. The theoretical substructure of STEM education that is seen as an important factor in attaining the expected qualities in human profile for the changing conditions of the 21st century has started to be formed. STEM education prioritizes team study and interdisciplinary approach. It is of great importance to put forward the intellectual structure of STEM education, that will play an important role in training people for the conditions of the present day, for better comprehension by the researchers, curriculum developers and practitioners. Moreover, when the literature on this concept is investigated, lack of comprehension of the concept and vision is seen. For this reason, the investigation of the development and current status of STEM education will contribute to literature in terms of understanding the intellectual structure of the concept. The dataset of the study is composed of all types of studies in at least one of the categories of Education &amp; Educational Research and “Education, Scientific Disciplines” published in Web of Science (WoS). Basing on WoS categories the relationship of the concept with other disciplines have been examined and visualized with web graphics on the accessed publications. It has been possible to refer to which focus the scientific data has been developed nourishing via the journals by mapping the journals in the dataset as citation giving and citation attaining. In addition to these, contribution of disciplines and countries to STEM education has been compared. © The Turkish Online Journal of Educational Technology.

AUTHOR KEYWORDS: Knowledge diffusion; Scientometrics; STEM education

DOCUMENT TYPE: Article

SOURCE: Scopus

Martin-Gonzalez, A., Chi-Poot, A., Uc-Cetina, V.

Usability evaluation of an augmented reality system for teaching Euclidean vectors

(2016) Innovations in Education and Teaching International, 53 (6), pp. 627-636. Cited 1 time.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84946866439&doi=10.1080%2f14703297.2015.1108856&partnerID=40&md5=6917302672af01cd18ffbe8d06a848ba

DOI: 10.1080/14703297.2015.1108856

AFFILIATIONS: Facultad de Matemáticas, Universidad Autónoma de Yucatán, Merida, Mexico

ABSTRACT: Augmented reality (AR) is one of the emerging technologies that has demonstrated to be an efficient technological tool to enhance learning techniques. In this paper, we describe the development and evaluation of an AR system for teaching Euclidean vectors in physics and mathematics. The goal of this pedagogical tool is to facilitate user’s understanding of physical concepts, such as magnitude, direction and orientation, together with basic vector-related operations like addition, subtraction and cross product. The result of the system usability scale showed our system’s usability and learnability. The system merges a real-world scenario with virtual elements controlled with a practical body-interactive interface. © 2015 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: augmented reality; Educational technology; interactive learning environments; mathematics education; system usability scale

DOCUMENT TYPE: Article

SOURCE: Scopus

Chen, S.-C., Yang, S.J.H., Hsiao, C.-C.

Exploring student perceptions, learning outcome and gender differences in a flipped mathematics course

(2016) British Journal of Educational Technology, 47 (6), pp. 1096-1112. Cited 1 time.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84927949098&doi=10.1111%2fbjet.12278&partnerID=40&md5=8dd694457fcc7b2ad67dd3e6c707b73f

DOI: 10.1111/bjet.12278

AFFILIATIONS: National Central University, Taiwan

ABSTRACT: The flipped classroom approach has recently gained prominence in education. However, a review of previous studies shows that the relationship associated with gender difference, student perceptions and learning outcomes has still remained unexplored, and there has been little discussion regarding flipped classroom environment. To fill this gap, this study aimed to provide a further study by developing an empirical study, extending perspectives of research for flipped classroom in education. This study was conducted to respond and investigate two main student perceptions in a flipped precalculus course, namely, situational interest and course satisfaction. By the self-developed perception measures, situational interest contained feeling, value and topic interest (three factors), while course satisfaction contained course design, system quality, course arrangement and online assessment (four factors). To respectively determine factors on final grades, we assessed the predicting power among those factors. Students' feedback and gender differences were also evaluated to provide a holistic profile of this flipped course. Results showed that feelings predict the final grades in males, while course design predicts the final grades in females. Moreover, the result also showed that even if females and males showed different topic interest in this course, they performed equally well. Some suggestions to effectively implement a flipped course were also provided from students' feedback. The implications of the results were provided for instructors' guidance in implementing flipped classroom. Finally, the study concluded that students' perceptions may be considered as motivational strategies in teaching and learning process to involve students in academic activities for improving their grades in flipped course. © 2015 British Educational Research Association

DOCUMENT TYPE: Article

SOURCE: Scopus

Genç, H.H.a , Aydin, S.b

Education on visualization of some complex physics problems in programing environment

(2016) Computer Applications in Engineering Education, 24 (6), pp. 876-886.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994441034&doi=10.1002%2fcae.21757&partnerID=40&md5=ba8e40f9b7a5a19bd6fb7f124ebcdbf2

DOI: 10.1002/cae.21757

AFFILIATIONS: Department of Electrical and Electronics Engineering, Institute of Science, Sakarya University, Sakarya, Turkey;

Department of Electronics and Automation, Vocational School of Technical Sciences, Marmara University, Goztepe TEF, Istanbul, Turkey

ABSTRACT: The realization of effective physics applications is thought as a privileged phenomenon due to the lack of transferring the basic laws of physics to produce products. In addition, the development of some applications depending on theory causes the discussion and questioning of scholars and competences which must be suitable for life. Assessment made with undergraduates and scholars shows that some difficulties are observed on embodiment of some physics problems in engineering and technical sciences. There are a lot of licensed softwares for analyzing the complex physical problems in technical fields. But these programs only help analyze the problems temporarily and they rarely help in long-term conceptualization of solving the problem. For undergraduates, embodiment of physics problems involved with related discipline will help them conceptualize these subjects permanently. For this purpose, some physics problems involved with electronic engineering, which are hardly conceptualized by students, have been selected as a pilot. The effects of temperature and the other parameters on the silicon semiconductor for both the forward and reverse-bias modes of operation curve, obtaining the hysteresis diagram for a control circuit and the visualization of hysteresis curve, the using of Monte Carlo statistically methods in numerical analysis of electromagnetic problems and the visualization of this method, are some selected subjects as a pilot. It is evaluated that besides classical teaching methods, approach will be discussed to help students analyze more complex physical problems if it is used as a methods in applied courses. © 2016 Wiley Periodicals, Inc. Comput Appl Eng Educ 24:876–886, 2016; View this article online at wileyonlinelibrary.com/journal/cae; DOI 10.1002/cae.21757. © 2016 Wiley Periodicals, Inc.

AUTHOR KEYWORDS: complex problems; computer aided; programming; STEM; visualization

DOCUMENT TYPE: Article

SOURCE: Scopus

Tellhed, U., Bäckström, M., Björklund, F.

Will I Fit in and Do Well? The Importance of Social Belongingness and Self-Efficacy for Explaining Gender Differences in Interest in STEM and HEED Majors

(2016) Sex Roles, pp. 1-11. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84992694909&doi=10.1007%2fs11199-016-0694-y&partnerID=40&md5=6e88d81090e62c8496c6cf04f7241bae

DOI: 10.1007/s11199-016-0694-y

AFFILIATIONS: Department of Psychology, Lund University, Box 213, Lund, Sweden

ABSTRACT: Throughout the world, the labor market is clearly gender segregated. More research is needed to explain women’s lower interest in STEM (Science, Technology, Engineering and Mathematics) majors and particularly to explain men’s lower interest in HEED (Health care, Elementary Education, and the Domestic spheres) majors. We tested self-efficacy (competence beliefs) and social belongingness expectations (fitting in socially) as mediators of gender differences in interest in STEM and HEED majors in a representative sample of 1327 Swedish high school students. Gender differences in interest in STEM majors strongly related to women’s lower self-efficacy for STEM careers and, to a lesser degree, to women’s lower social belongingness expectations with students in STEM majors. Social belongingness expectations also partly explained men’s lower interest in HEED majors, but self-efficacy was not an important mediator of gender differences in interest in HEED. These results imply that interventions designed to lessen gender segregation in the labor market need to focus more on the social belongingness of students in the gender minority. Further, to specifically increase women’s interest in STEM majors, we need to counteract gender stereotypical competence beliefs and assure women that they have what it takes to handle STEM careers. © 2016 The Author(s)

AUTHOR KEYWORDS: Belongingness; Gender; HEED; Interest; Self-efficacy; STEM

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Barak, M., Assal, M.

Robotics and STEM learning: students’ achievements in assignments according to the P3 Task Taxonomy—practice, problem solving, and projects

(2016) International Journal of Technology and Design Education, pp. 1-24. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84992756713&doi=10.1007%2fs10798-016-9385-9&partnerID=40&md5=15bf60793784220c4b3ee26faa6cac42

DOI: 10.1007/s10798-016-9385-9

AFFILIATIONS: Department of Science and Technology Education, Ben-Gurion University of the Negev, Beer Sheva, Israel

ABSTRACT: This study presents the case of development and evaluation of a STEM-oriented 30-h robotics course for junior high school students (n = 32). Class activities were designed according to the P3 Task Taxonomy, which included: (1) practice—basic closed-ended tasks and exercises; (2) problem solving—small-scale open-ended assignments in which the learner can choose the solution method or arrive at different answers; and (3) project-based learning—open-ended challenging tasks. The research aimed at exploring students’ working patterns, achievements in learning the course, and the impact of this experience on students’ motivation to learn STEM subjects. Evaluation tools included a final exam on factual, procedural and conceptual knowledge in the STEM subject learned in the course, class observations, interviews with the students, and administrating an attitude questionnaire before and after the course. Since the experimental class was quite heterogenic in regard to students’ prior learning achievements and motivation to learn, some of the students completed just the basic exercises, others coped well with the problem-solving tasks, and only a few took it upon themselves to carry out a complex project. However, all students showed high motivation to learn robotics and STEM subjects. In summary, robotics provides a very rich and attractive learning environment for STEM education. Yet, the realization of this potential depends largely on careful design of the course methodology and especially the students’ assignments in the class. One should recognize that often only some students are capable of learning a new subject on their own through project work, and these students also need to gain additional knowledge and skills before dealing with complex projects. © 2016 Springer Science+Business Media Dordrecht

AUTHOR KEYWORDS: Robotics; STEM; Task taxonomy

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Vennix, J., Den Brok, P., Taconis, R.

Perceptions of STEM-based outreach learning activities in secondary education

(2016) Learning Environments Research, pp. 1-26. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84992371876&doi=10.1007%2fs10984-016-9217-6&partnerID=40&md5=794b8d8e7c07cd50f135fcbad0a24890

DOI: 10.1007/s10984-016-9217-6

AFFILIATIONS: Eindhoven School of Education, Eindhoven University of Technology, P.O. Box 513, Eindhoven, Netherlands

ABSTRACT: We investigated and compared the learning environment perceptions of students, teachers and guides who participated in Science, Technology, Engineering and Mathematics (STEM)-based outreach activities in secondary education. In outreach activities, schools and teachers work together with companies and other external institutions in learning activities in order to motivate students for the STEM domain. In this study, we identified characteristics of outreach activities that explain variance in perceptions of students. Data were gathered from 729 high-school students as well as 35 teachers and guides in 12 activities both in the US and the Netherlands. A questionnaire was used to asses outreach activities based on subscales from validated questionnaires such as the What Is Happening In this Classroom, Constructivist Learning Environments Survey, Classroom Environment Scale and the Learning Climate Questionnaire. Teachers’ perceptions were more positive than students’ perceptions for most scales, while guides perceived the outreach learning environment in almost the same way as students. Student perceptions were very positive for outreach activities. Outreach activity characteristics such as teaching method and emphasis were found to be the most important factors in explaining variance in students’ perceptions between activities. Long-term problem-based activities and the perspective of new views of science and scientists were perceived as providing the most positive learning environments. Additionally, outreach learning environments can create opportunities to increase students’ motivation in STEM. © 2016 The Author(s)

AUTHOR KEYWORDS: Outreach learning activities; Secondary education; STEM; Student perceptions

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Bakar, W.N.W., Yusoff, N.S.M., Husain, W.S.W., Hassan, S.H.C.

The effectiveness of Je Vous teaching and learning strategies on weak learners' performance in mathematics

(2015) 2015 International Symposium on Mathematical Sciences and Computing Research, iSMSC 2015 - Proceedings, art. no. 7594085, pp. 389-391.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995688322&doi=10.1109%2fISMSC.2015.7594085&partnerID=40&md5=d6009950943c85db2fa26aebda887133

DOI: 10.1109/ISMSC.2015.7594085

AFFILIATIONS: Fakulti Sains Komputer Dan Matematik (FSKM), Universiti Teknologi Mara (UiTM), Kelantan, Malaysia

ABSTRACT: Weak learners can be identified in mathematics classrooms. They are the students who have problems in adapting to the learning process, slow to understand concepts, unable to retain information for long and have difficulties in applying their knowledge to various situations. Weak learners should be helped because they are the asset of the country and reducing their numbers, means, a better chance for the country to achieve the mission as a developed country. The aim of this paper is to discuss about the effectiveness of the implementation of Je Vous Teaching and Learning Strategies on weak learners. 50 weak learners were involved in this study. They were from Pre Commerce students of Mengubah Destini Anak Bangsa Programme Semester December 2012 to April 2013 at Mara University of Technology Kelantan branch, Malaysia. To achieve this objective JE VOUS Teaching and Learning Strategies involve five phases such as gathering students' Mathematics results in SPM examination, giving diagnostic test, imparted knowledge through direct teaching, having peer mentoring and doctor - patient session as well as evaluating the students' performance. The result indicates that there is an improvement in students understanding, thus helping them to score in their examinations. © 2015 IEEE.

AUTHOR KEYWORDS: auditory; kinaesthetic; visual animation; weak learners

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Gopal, K., Shitan, M.

Cluster analysis of top 200 universities in Mathematics

(2015) 2015 International Symposium on Mathematical Sciences and Computing Research, iSMSC 2015 - Proceedings, art. no. 7594089, pp. 408-413.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995569493&doi=10.1109%2fISMSC.2015.7594089&partnerID=40&md5=2f37ad614ca0f96c8bdcc3aef8ad9b95

DOI: 10.1109/ISMSC.2015.7594089

AFFILIATIONS: Institute for Mathematical Research (INSPEM), Universiti Putra Malaysia (UPM), UPM Serdang, Selangor, Malaysia

ABSTRACT: University rankings are becoming a vital performance assessment for higher learning institutions worldwide. Besides the overall rankings, the universities are also ranked by subjects serving as comprehensive guide to discover the specialist strengths of universities worldwide by highlighting top 200 universities for a range of 30 individual popular subjects. Data for this ranking purpose consist four variables namely the academic reputation, employer reputation, citation per paper and H-index citations. In this ranking, universities are ranked according to their overall score calculated from linear combination of the aforementioned variables and their respective weightings. As the existing ranking technique based on overall score appears to be simple and since the rankings data are of multivariate nature, therefore it is possible to use multivariate statistical technique like cluster analysis. Agglomerative hierarchical cluster analysis of top 200 QS ranked universities by Mathematics subject area 2014 has been performed to obtain natural clustering of the universities in an objective manner. The agreement between cluster analysis and existing QS rankings is verified and it is suggested that the distance between universities can be used as an alternative measure to rank universities. Cluster analysis applied on the same variables would serve as an alternative way to rank universities and to look at the rankings in a different perspective. © 2015 IEEE.

AUTHOR KEYWORDS: Hierarchical cluster analysis; QS World University Rankings; Rankings by Mathematics subject

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Mahad, N.F.a , Alias, S.b , Zamili, S.N.Z.S.c , Zulkifly, L.N.L.c , Muhamad, A.N.c

The application of Zero-One Goal Programming in selecting the optional co-curriculum and co-academic activities in primary school: A case study

(2015) 2015 International Symposium on Mathematical Sciences and Computing Research, iSMSC 2015 - Proceedings, art. no. 7594087, pp. 396-401.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995617548&doi=10.1109%2fISMSC.2015.7594087&partnerID=40&md5=f6750c3a07173c60b3957fcef1ab1960

DOI: 10.1109/ISMSC.2015.7594087

AFFILIATIONS: Mathematics Department, Universiti Teknologi MARA Negeri Sembilan, Seremban, Malaysia;

Mathematics Department, Universiti Teknologi MARA Kelantan, Machang, Malaysia;

Mathematics Department (Undergraduate Stud.), Universiti Teknologi MARA Negeri Sembilan, Seremban, Malaysia

ABSTRACT: All the students in primary school have to join the co-curriculum and co-academic activities. Zero-One Goal Programming (ZOGP) model is used in this research to select the optional co-curriculum and co-academic activities. To demonstrate this model, this study focused on Sekolah Kebangsaan Taman Rasah Jaya, Seremban as the case study. LINGO 11.0 software is used to analyze the data. The results showed that there are only 23 out of 29 of the optional activities are selected; Science Association 1, Science Association 2, Mathematics Association 1, Mathematics Association 2, English Association, Malay Association, Islamic Association 1, Islamic Association 2, KH Association 1, KH Association 2, ICT Club 1, ICT Club 2, Music Club 1, Music Club 2, Chess Club 1, Chess Club 2, Safety Club 1, Safety Club 2, SPBT Club 1, SPBT Club 2, Library Club 1, Library Club 2 and Elementary School Music Carnival. The total budget to implement these activities in 35 days can be minimized by RM1,356.00. Therefore, the total budget will be RM39,337.00. © 2015 IEEE.

AUTHOR KEYWORDS: co-academic; cocurriculum; project selection; Zero one goal programming

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Pellas, N.a , Kazanidis, I.b , Konstantinou, N.c , Georgiou, G.d

Exploring the educational potential of three-dimensional multi-user virtual worlds for STEM education: A mixed-method systematic literature review

(2016) Education and Information Technologies, pp. 1-45. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84991105241&doi=10.1007%2fs10639-016-9537-2&partnerID=40&md5=983847fba4d4887f68aff447cbc42544

DOI: 10.1007/s10639-016-9537-2

AFFILIATIONS: Department of Product and Systems Design Engineering, University of the Aegean, Konstantinoupoleos 1, Hermoupolis, Syros, Cyclades, Greece;

Advanced Educational Technologies & Mobile Applications Lab, Eastern Macedonia and Thrace Institute of Technology, Ag. Loukas, Kavala, Greece;

Department of Psychology, Panteion University, Athens, Greece;

Ministry of Education, Research and Religious Affairs, Regional Directorate of Primary Education of Thesprotia, Athens, Greece

ABSTRACT: The present literature review builds on the results of 50 research articles published from 2000 until 2016. All these studies have successfully accomplished various learning tasks in the domain of Science, Technology, Engineering, and Mathematics (STEM) education using three-dimensional (3-D) multi-user virtual worlds for Primary, Secondary and Higher education, in order to: (a) present an overview about the potential contribution of this technology in practice-based perspectives on knowledge and learning; (b) identify the theoretical underpinnings based on contemporary learning theories and pedagogical approaches that leverage content design characteristics, with the respect to the constructs of their instructional design methods; (c) suggest a synthesis of the relevant literature about how the utilization of 3-D multi-user virtual worlds have affected positively learning outcomes based on students’ achievements; (d) concretize the educational potential and instructional affordances covering the pedagogical (socio-) cognitive, technological-operational and financial perspectives; and lastly (e) propose an instructional design workflow to contextualize pedagogical content design principles for the implementation of different learning scenarios in STEM courses. The overviewed articles ascertained that 3-D multi-user virtual worlds have many instructional and technological affordances as candidate learning platforms for different educational levels, influencing to a large extent students’ attendance, knowledge transfer, skill acquisition, hands-on digital experience and positive attitudes in laboratory experimental exercises. This technology gives to users the opportunity to manage learning materials more effectively and efficiently during the teaching process. The vast majority of educational benefits and potential enhanced the degree of their engagement and participation, contributing positively to their achievements. © 2016 Springer Science+Business Media New York

AUTHOR KEYWORDS: 3-D multi-user virtual worlds; Instructional design; Learning outcomes; Learning theories; STEM education

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Wong, V.a , Dillon, J.b , King, H.a

STEM in England: meanings and motivations in the policy arena

(2016) International Journal of Science Education, 38 (15), pp. 2346-2366.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994558921&doi=10.1080%2f09500693.2016.1242818&partnerID=40&md5=2b3368fe620c6e6db581b5972113738c

DOI: 10.1080/09500693.2016.1242818

AFFILIATIONS: School of Education, Communication and Society, King’s College London, London, United Kingdom;

Graduate School of Education, University of Bristol, Bristol, United Kingdom

ABSTRACT: STEM, an acronym for Science, Technology, Engineering and Mathematics, is widely used in science education. There is confusion, however, as to its provenance and meaning which is potentially problematic. This study examines the purpose of STEM practice in education in England and asks if there are differences in perceptions of STEM between science and mathematics educator stakeholders. The study’s contribution to the literature is its unusual focus on those who were responsible for making and enacting national STEM policy. A two-phase qualitative approach was followed comprising an analysis of government documentation together with semi-structured interviews with key contributors to the science and mathematics education discourse. Findings suggest that there is a disconnect between the interpretations of the science and mathematics educators with a danger-advantage dichotomy to participation in STEM being perceived by the mathematics educators. Early aims of the STEM agenda, including increasing diversity, gave way to a focus on numbers of post-16 physics and mathematics students. We conclude that if the term STEM is to continue to be used then there is a need for greater clarity about what it represents in educational terms and a wider debate about its compatibility with the aims of science education for all. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: mathematics; policy development; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Chen, B.a b c , Huang, Y.a b c , Rao, Y.a b c , Hu, Y.b d , Wang, Y.b e , Zhang, C.c f

The Beauty of Geometry: A touch-operation-based DGS for mathematics education

(2016) ICCSE 2016 - 11th International Conference on Computer Science and Education, art. no. 7581621, pp. 443-447.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994096842&doi=10.1109%2fICCSE.2016.7581621&partnerID=40&md5=4a54e7afd7ff1049a1625b860505b463

DOI: 10.1109/ICCSE.2016.7581621

AFFILIATIONS: School of Computer Science and Educational Software, Guangzhou University, Guangzhou, China;

GuangDong Provincial Engineering Technology Research Center for Mathematical Educational Software, Guangzhou, China;

Guizhou Prov. Academician Workstation of Educational Big Data Technology and Educational Mathematics, Guiyang, China;

Network and Modern Education Technology Center, Guangzhou University, Guangzhou, China;

South China Institute of Software Engineering, Guangzhou University, Guangzhou, China;

Guizhou Provincial Educational Science Academy, Guiyang, China

ABSTRACT: The Beauty of Geometry, a touch-operation-based Dynamic Geometry Software (DGS) we develop for mathematics education by Objective-C, is introduced. The paper starts with the main contents of the Beauty of Geometry, including Intelligent drawing, Dynamic geometry, Geometric transformations, Animation, Measurement and Sharing, then we talk about the features of the system from three aspects, and consider a concrete example to show it how to make geometry learning be more simple and intuitive, finally we make a conclusion that the exploring of the touch-operation-based DGS is still in the initial stage, and propose what to do next to make the Beauty of Geometry smart and friendly. © 2016 IEEE.

AUTHOR KEYWORDS: Dynamic Geometry Software (DGS); Gesture operation; Mathematics education; The Beauty of Geometry; Touch screen

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Xu, Z.a , Jin, Y.a , Johnson, S.b , Gao, W.c , Miao, H.a , Wei, Q.c

Random inspection evaluation of Shanghai graduate dissertation based on Bayesian decision tree

(2016) ICCSE 2016 - 11th International Conference on Computer Science and Education, art. no. 7581631, pp. 501-504.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994091569&doi=10.1109%2fICCSE.2016.7581631&partnerID=40&md5=f93250b989357c34284085d3026ae5c3

DOI: 10.1109/ICCSE.2016.7581631

AFFILIATIONS: School of Computer Engineering and Science, Shanghai University, Shanghai, China;

XianDa College of Economics and Humanities, Shanghai International Studies University, Shanghai, China;

School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai 200093, China

ABSTRACT: In order to improve the quality of graduate dissertation and examine the quality of graduate education, the mechanism of graduate dissertation random inspection evaluation in Shanghai has been operated for more than ten years. Evaluation experts evaluate the quality of dissertation by using subitem evaluation method rather than comprehensive evaluation method to reduce the risk of misjudgment. Decision tree is a model to explain the data processing from subitem evaluation to comprehensive evaluation. To reduce the disadvantage of decision tree algorithm, the Bayesian decision tree is applied for denoising. The experiment result shows that our method can predict the comprehensive evaluations effectively according to subitem evaluations. © 2016 IEEE.

AUTHOR KEYWORDS: Bayesian decision tree; Comprehensive evaluation; Graduate dissertation; Subitem evaluation

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Yu, W., Xiaowei, Y.

Application of decision tree for MRI images of premature brain injury classification

(2016) ICCSE 2016 - 11th International Conference on Computer Science and Education, art. no. 7581683, pp. 792-795.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994130143&doi=10.1109%2fICCSE.2016.7581683&partnerID=40&md5=3ab266bdabeddc0e31a5e0eb7b72d6cf

DOI: 10.1109/ICCSE.2016.7581683

AFFILIATIONS: Affiliated Hospital of Hebei University, Hebei Baoding, China

ABSTRACT: An optimization classification algorithm for MRI images of premature brain injury is introduced. Based on the shortcomings of the classical ID3 algorithm in dealing with the continuous attributes of medical image, the new algorithm selects the testing feature by comparing the information gain ratio and adds the handling methods for filling null values. Then it discrete the continuous attributes by dividing them into segments to classify the object. The result shows that the new algorithm can accurately classify the MRI images. © 2016 IEEE.

AUTHOR KEYWORDS: classification; data mining; decision tree; medical images

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Xiahou, J.a , Xu, Y.a , Zhang, S.a , Liao, W.b

Customer profitability analysis of automobile insurance market based on data mining

(2016) ICCSE 2016 - 11th International Conference on Computer Science and Education, art. no. 7581649, pp. 603-609.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994112023&doi=10.1109%2fICCSE.2016.7581649&partnerID=40&md5=2976a0fb7efad40b5cb62a21e2f2298f

DOI: 10.1109/ICCSE.2016.7581649

AFFILIATIONS: Software School Xiamen University, Xiamen, China;

Management School Xiamen University, Xiamen, China

ABSTRACT: Data mining technology is an interdiscipline using theory and technology of artificial intelligence, machine learning, statistics and other fields. It can extract implicit but useful information and knowledge from vast amount of historical data for the enterprise, and provide solid support for the decision of company. Combining with the rate reform of domestic automobile insurance industry, this paper discusses the application of data mining technology to the customer profitability, finds out the rule of classification before and after the rate reform, and shows the progress of customer profitability analysis by using decision tree. © 2016 IEEE.

AUTHOR KEYWORDS: Automobile Insurance; Customer Profitability; Data Mining; Premium Rate Reform

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Nie, Y., Liu, L.

Hierarchical retrieval of human motion data based on semantic feature

(2016) ICCSE 2016 - 11th International Conference on Computer Science and Education, art. no. 7581670, pp. 729-732.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994140303&doi=10.1109%2fICCSE.2016.7581670&partnerID=40&md5=62a78103b8b291e5f8ff71c107e1e491

DOI: 10.1109/ICCSE.2016.7581670

AFFILIATIONS: School of Computer and Information Technology, Northeast Petroleum University, DaQing, China

ABSTRACT: In motion capture data reusing process, because of the huge amount of data, motion data retrieval is rather time-consuming, and the length of motion data is not the same, so the motion data that similar in logical is not similar in numerical. This paper extracts the motion features, creates the semantic indexing tree, and proposes a hierarchical motion data retrieval method, divides the retrieval process into three levels: semantic indexing retrieval, motion feature retrieval, and motion data retrieval, use the DTW as the algorithm for calculating the similar for sample motion and motion data in database, this hierarchical retrieval improves the retrieval speed, at the same time, considers the recall and precision of retrieval, provides an effective way for the reuse of motion data. © 2016 IEEE.

AUTHOR KEYWORDS: capture data; motion feature; motion retrieval

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Yu, W., Dongming, S.

Premature brain damage image classification algorithm based on association rules

(2016) ICCSE 2016 - 11th International Conference on Computer Science and Education, art. no. 7581682, pp. 788-791.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84993159407&doi=10.1109%2fICCSE.2016.7581682&partnerID=40&md5=e46214c152eb6e0032689175ba3b481d

DOI: 10.1109/ICCSE.2016.7581682

AFFILIATIONS: Affiliated Hospital of Hebei University, Hebei Baoding, China

ABSTRACT: Aiming at the particularity of MRI images, the ARC algorithm which is suitable for medical image processing is present. The new method introduces the bi-support association rules based on FP-tree. In the process of generating the rule of association class and constructing the FP-tree, the maximum support is introduced on the premise of minimal support. It can make the support of discovered rules be between the maximum support and minimal support. so through the bi-support, the interference in the rules is excluded. Experiments shows that this ARC method could achieve better results in practice than CMAR in the operational efficiency and classification accuracy. It is very effective in CWMD digital image classification. © 2016 IEEE.

AUTHOR KEYWORDS: associative rules; classification; CWMD image; data mining; FP-tree

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Wang, B., Wang, Q., Shou, G., Hu, Y., Guo, Z.

User relationship analysis in campus based on WiFi Hotspots

(2016) ICCSE 2016 - 11th International Conference on Computer Science and Education, art. no. 7581605, pp. 347-351.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994070695&doi=10.1109%2fICCSE.2016.7581605&partnerID=40&md5=dd38b8e848c18372b958ff6a975fdebc

DOI: 10.1109/ICCSE.2016.7581605

AFFILIATIONS: Beijing Key Lab. of Network System Architecture and Convergence, Beijing University of Posts and Telecommunications, Beijing, China

ABSTRACT: With the rapid development of mobile Internet, the way users access the network becomes diverse, which provide much convenience for us to collect huge amount of users' information. In this paper, we present a model of measuring relationship between two users in campus and build a wireless data analysis system called WiCloud to verify our model. This work has several potential applications such as recommendation, advertisement targeting, and privacy protection. A novel method using decision tree model, which is usually used for decision analysis, is proposed to measure the relationship between two users in wireless network. Experiments results on real datasets validate our ideas and verify the feasibility and efficiency. Experimental results show that the accuracy of the training set is 100%, while the accuracy of the test set is 88.9%. © 2016 IEEE.

AUTHOR KEYWORDS: decision tree; WiFi Hotspots; wireless data analysis system

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Kollöffel, B., de Jong, T.

Can performance feedback during instruction boost knowledge acquisition? Contrasting criterion-based and social comparison feedback

(2016) Interactive Learning Environments, 24 (7), pp. 1428-1438.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84924463076&doi=10.1080%2f10494820.2015.1016535&partnerID=40&md5=aea446838582b509751d1277951e4859

DOI: 10.1080/10494820.2015.1016535

AFFILIATIONS: Department of Instructional Technology, University of Twente, P.O. Box 217, Enschede, Netherlands

ABSTRACT: Feedback indicating how well students are performing during a learning task can be very stimulating. In this study with a pre- and post-test design, the effects of two types of performance feedback on learning results were compared: feedback during a learning task was either stated in terms of how well the students were performing relative to other students (social comparison feedback) or relative to an absolute criterion (criterion-based feedback). Thirty-four students in secondary vocational engineering education were randomly assigned to one of two conditions. In both conditions, students worked together in small groups. All groups completed a math learning task, during which they received either social comparison feedback or criterion-based performance feedback. The findings showed that the type of feedback had a strong effect on learning outcomes: the post-test scores and gains of students in the social comparison condition were significantly higher than those of students in the criterion-based feedback condition. © 2015 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: collaborative learning; interactive learning environments; mathematics; performance feedback; social comparison; teaching/learning strategies

DOCUMENT TYPE: Article

SOURCE: Scopus

Goldman, A.D.a , Penner, A.M.b

Exploring international gender differences in mathematics self-concept

(2016) International Journal of Adolescence and Youth, 21 (4), pp. 403-418.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84892418709&doi=10.1080%2f02673843.2013.847850&partnerID=40&md5=2c20a59e5181f3bfd5ebd569a503cc7e

DOI: 10.1080/02673843.2013.847850

AFFILIATIONS: Department of Education, Claremont Graduate University, Claremont, CA, United States;

Department of Sociology, University of California, Irvine, CA, United States

ABSTRACT: This study provides an international perspective on mathematics by examining mathematics self-concept, achievement, and the desire to enter a career involving mathematics among eighth graders in 49 countries. Using data from the Trends in International Mathematics and Science Study, this study shows that self-concept in mathematics is more closely related to the desire to enter a career using mathematics than achievement is. Further, while gender differences in mathematics self-concept are smaller in more egalitarian countries, both girls and boys have lower mathematics self-concepts and less interest in mathematics careers in these countries. These findings reveal a policy paradox: policies aimed at training the next generation of STEM professionals often highlight the need to close the gender gap, but countries with smaller gender gaps have fewer boys and girls interested in mathematics-intensive careers. We conclude by highlighting the importance of disentangling instrumental and expressive aspects of gender inequality in STEM fields. © 2014 Taylor & Francis.

AUTHOR KEYWORDS: eighth graders; gender inequality; international education; mathematics achievement; mathematics self-concept; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

An, S.A., Tillman, D.A., Zhang, M., Robertson, W., Tinajero, J.

Hispanic Preservice Teachers’ Peer Evaluations of Interdisciplinary Curriculum Development: A Self-Referenced Comparison Between Monolingual Generalists and Bilingual Generalists

(2016) Journal of Hispanic Higher Education, 15 (4), pp. 291-309.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84984824075&doi=10.1177%2f1538192715612912&partnerID=40&md5=4014fe475e71a7b7283ad64992d05272

DOI: 10.1177/1538192715612912

AFFILIATIONS: The University of Texas at El Paso, United States

ABSTRACT: This study investigated preservice teachers from two teacher education programs, elementary generalists and bilingual generalists (who will teach all subjects in both English and Spanish), about their instructional design abilities via examination of their ability to integrate interdisciplinary-themed activities into mathematics lessons. The findings illustrate the value provided by differentiating teacher preparation for preservice bilingual teachers—especially for challenging STEM-related (science, technology, engineering, and mathematics) subjects such as mathematics—based on their distinctive pedagogical, cognitive, and linguistic requirements. © 2015, © The Author(s) 2015.

AUTHOR KEYWORDS: bilingual education; instructional design; peer evaluation; teacher education

DOCUMENT TYPE: Article

SOURCE: Scopus

Headley, M.G., Swoboda, C.M., Foote, L.

What’s missing in longitudinal studies conducted in the U.S. with implications for mathematics education?

(2016) International Journal of Research and Method in Education, 39 (4), pp. 383-400. Cited 1 time.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84966697338&doi=10.1080%2f1743727X.2016.1184245&partnerID=40&md5=b3802f5d550fecb5dada463ffc4d0a29

DOI: 10.1080/1743727X.2016.1184245

AFFILIATIONS: College of Education, Criminal Justice, and Human Services, Educational Studies, University of Cincinnati, Cincinnati, OH, United States

ABSTRACT: ‘What works’ policies are the latest incarnation of best practices in educational research. Instituted by various organisations internationally, they define what kind of research counts as ‘evidence’ for reform-oriented decision-making. While some countries rely on systematic analyses and meta-analyses, the U.S. favours primary quantitative longitudinal research designs as evidence. Critics claim that institutionalising methods will distort educational research. This commentary discusses these two concerns about the research designs favoured in the American ‘what works’ milieu: missing research and missing data. To explore whether those concerns are warranted, we focus on mathematics education, a national priority in the U.S. After establishing enduring questions in mathematics education, we provide primers on quantitative longitudinal research designs and the analysis of missing data due to attrition. Then, we address these questions about the state of research: As a research community, are we missing research with implications for mathematics education? Are we missing data with implications for the inferences that can be made? This review of research questions and analyses in recent studies suggests missing data poses a greater threat than missing research. Finally, we make recommendations for minimising the risk of missing evidence that will be of interest to international educational researchers in any discipline. © 2016 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: Longitudinal design; mathematics education; missing data; research policy

DOCUMENT TYPE: Article

SOURCE: Scopus

Mujtaba, T., Reiss, M.J.

“I Fall Asleep in Class … But Physics Is Fascinating”: The Use of Large-Scale Longitudinal Data to Explore the Educational Experiences of Aspiring Girls in Mathematics and Physics

(2016) Canadian Journal of Science, Mathematics and Technology Education, 16 (4), pp. 313-330.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995610417&doi=10.1080%2f14926156.2016.1235743&partnerID=40&md5=9aede73026ae210f96c29b422d157bb2

DOI: 10.1080/14926156.2016.1235743

AFFILIATIONS: UCL Institute of Education, University College London, London, United Kingdom

ABSTRACT: This article explores how students' aspirations to study mathematics or physics in post-16 education are associated with their perceptions of their education, their motivations, and the support they feel they received. The analysis is based on the responses of around 10,000 students in England in Year 8 (age 12–13) and then in Year 10 (age 14–15). The students were first surveyed during 2008–2009 and then followed up in 2010–2011. t-tests revealed a decline in their perceptions of their mathematics and physics education. Factor analyses indicated subject-specific constructs that were associated with gender aspiration groups (i.e., high-aspiring girls, high-aspiring boys, low-aspiring girls, low-aspiring boys). High-aspiring girls were more likely than low-aspiring boys to be positive about mathematics/physics education, motivation in these subjects, and support received. However, high-aspiring girls were less likely than high-aspiring boys to be encouraged by their teachers and families to continue with these subjects post-16 and had lower self-concepts, intrinsic valuations, and perceptions of lessons. Low-aspiring girls reported the least favorable views of their mathematics/physics education of all four gender aspiration groups. Findings were generally similar for mathematics and physics, although students overall responded more favorably to mathematics than to physics. The quantitative findings are illustrated with extracts from longitudinal interviews (ages 15, 16, and 17) of two high-aspiring girls. © 2016 The Author(s). Published with license by Taylor & Francis © Tamjid Mujtaba and Michael J. Reiss.

DOCUMENT TYPE: Article

SOURCE: Scopus

Williams, K.E.a , White, S.L.J.a , MacDonald, A.b

Early mathematics achievement of boys and girls: Do differences in early self-regulation pathways explain later achievement?

(2016) Learning and Individual Differences, 51, pp. 199-209.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84989315938&doi=10.1016%2fj.lindif.2016.09.006&partnerID=40&md5=3000f4b9a57915ef554ec8adca81a285

DOI: 10.1016/j.lindif.2016.09.006

AFFILIATIONS: School of Early Childhood, Queensland University of Technology, GPO Box 2434, Brisbane, Queensland, Australia;

Research Institute for Professional Practice, Learning, and Education, Charles Sturt University, PO Box 789, Albury, New South Wales, Australia

ABSTRACT: The degree to which a true gender gap exists in mathematics achievement is still debated, and empirically-supported explanations for any gap rarely address very early childhood self-regulatory pathways. This study examines whether mathematics achievement at 8–9 years differs by gender, how achievement is associated with self-regulatory pathways beginning at 2–3 years of age, and whether these pathways differ by gender. Participants were 5107 children involved in the nationally-representative Longitudinal Study of Australian Children (LSAC). Boys outperformed girls in mathematics achievement and girls generally had better early attentional and emotional regulation. Path analysis revealed that attentional regulation was directly associated with mathematics achievement from 4 to 5 years, and emotional regulation was indirectly associated. These self-regulatory pathways to mathematics achievement were not moderated by gender. We discuss the implications for further research and new approaches to early years mathematics education that embed self-regulatory support and development for all children. © 2016 Elsevier Inc.

AUTHOR KEYWORDS: Early childhood; Gender; Mathematics; Self-regulation

DOCUMENT TYPE: Article

SOURCE: Scopus

Treacy, P.a , Faulkner, F.b , Prendergast, M.c

Analysing the correlation between secondary mathematics curriculum change and trends in beginning undergraduates’ performance of basic mathematical skills in Ireland

(2016) Irish Educational Studies, 35 (4), pp. 381-401.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84991454062&doi=10.1080%2f03323315.2016.1243067&partnerID=40&md5=4c43a161ff08861ab038896f5c3dc2a1

DOI: 10.1080/03323315.2016.1243067

AFFILIATIONS: College of Education, University of Derby, Derby, United Kingdom;

Hospitality Management and Tourism Department, Dublin Institute of Technology, Dublin, Ireland;

School of Education, Trinity College Dublin, Dublin, Ireland

ABSTRACT: The phenomenon in which students enter university under-prepared for the mathematical demands of their undergraduate courses, regularly referred to as the ‘Maths Problem’, has been widely reported in Ireland, UK, Australia, and the US. This issue has been of particular concern in Ireland recently, with beginning undergraduates’ performance of basic mathematical skills showing signs of significant decline in recent years. New mathematics curricula, commonly referred to as ‘Project Maths’, were gradually introduced into the Irish secondary school education system from 2010 onwards. These new curricula aim to place greater emphasis on student understanding of mathematical concepts, use of contexts, and applications of mathematics. This study analyses, through mathematics diagnostic test data gathered between 2008 and 2014, the change in the basic mathematical skills of beginning undergraduates over the time period in which the new mathematics curricula were introduced to secondary education in Ireland. It was found that students’ basic mathematical skills have declined over the time period during which the new mathematics curricula were introduced. Significant declines in beginning undergraduates’ performance of basic mathematical skills were observed during the period 2008–2014, particularly among students who have achieved Higher Level C grades and Higher Level D grades. © 2016 Educational Studies Association of Ireland.

AUTHOR KEYWORDS: basic mathematical skills; curriculum change; mathematical competencies; mathematical under-preparedness; Project Maths

DOCUMENT TYPE: Article

SOURCE: Scopus

Radović, S., Passey, D.

Digital resource developments for mathematics education involving homework across formal, non-formal and informal settings

(2016) Curriculum Journal, 27 (4), pp. 538-559.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84964355616&doi=10.1080%2f09585176.2016.1158726&partnerID=40&md5=f0b0fdc63837b545db66eaf340addb54

DOI: 10.1080/09585176.2016.1158726

AFFILIATIONS: Department of Educational Research, Centre for Technology Enhanced Learning, Lancaster University, Bailrigg, United Kingdom

ABSTRACT: The aim of this paper is to explore further an under-developed area – how drivers of curriculum, pedagogy and assessment conceptions and practices shape the creation and uses of technologically based resources to support mathematics learning across informal, non-formal and formal learning environments. The paper considers: the importance of mathematics learning in informal and non-formal as well as formal settings; how curriculum focuses on pedagogy supporting these needs, contrasting this focus in England and Serbia; and in these contexts, the roles of homework, the potential of technologies and the roles of the teacher. Technological developments to support mathematics learning for 11- to 14-year-old pupils in the two countries are explored and contrasted, and ways that recent developments inform our understandings of formal, informal and non-formal learning through learning activities, learning support and settings are modelled. The conception of ‘extended pedagogies’ is introduced; implications are outlined. © 2016 British Educational Research Association.

AUTHOR KEYWORDS: Curriculum; extended pedagogies; homework; learning environments; mathematics education; web technologies

DOCUMENT TYPE: Article

SOURCE: Scopus

Han, S.a , Capraro, R.M.b , Capraro, M.M.b

How science, technology, engineering, and mathematics project based learning affects high-need students in the U.S.

(2016) Learning and Individual Differences, 51, pp. 157-166.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84987926267&doi=10.1016%2fj.lindif.2016.08.045&partnerID=40&md5=398f443d6504f76ddfdcb31b7bc2a4dd

DOI: 10.1016/j.lindif.2016.08.045

AFFILIATIONS: Sungkyunkwan University, South Korea;

Texas A&M University, Aggie STEM Center, United States

ABSTRACT: The purpose of this study was to investigate how science, technology, engineering, and mathematics (STEM) project based learning (PBL) affected high-need students in the United States (U.S.) in terms of their academic achievement. Among high-need students in the U.S., we focused on two student groups: Hispanic and at-risk students. The participants included 528 students in the three STEM PBL high schools and 2688 students in non-STEM PBL schools in the same region. Approximately 71% of the participants were Hispanic, at-risk, or Hispanic and at-risk. Latent growth modeling with repeated measures was used to analyze the data. The data were mathematics tests from 2008 to 2010 of the Texas Assessment of Knowledge and Skills. STEM PBL instruction positively influenced Hispanic students' achievement in mathematics, but not at-risk students. The findings of this study imply that curriculum integrating STEM PBL may help Hispanic students having language and cultural differences improve communication and collaboration skills in classrooms. © 2016 Elsevier Inc.

AUTHOR KEYWORDS: Latent growth modeling; Longitudinal dataset; Project based learning; STEM education

DOCUMENT TYPE: Article

SOURCE: Scopus

Muddeen, F., Mallalieu, K.

Examinations and remediation actions for the mathematics problem in electrical engineering at the University of the West Indies

(2016) International Journal of Electrical Engineering Education, 53 (4), pp. 314-330.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84989929883&doi=10.1177%2f0020720916630324&partnerID=40&md5=1ad9973702781343eb28f30e709fad9e

DOI: 10.1177/0020720916630324

AFFILIATIONS: Department of Electrical and Computer Engineering, University of the West Indies, St Augustine Campus, St Augustine, NA, Trinidad and Tobago

ABSTRACT: The Department of Electrical and Computer Engineering at The University of the West Indies' (UWI') St Augustine Trinidad and Tobago Campus conducted a review and revision of its BSc mathematics programming in 2009. The review was framed to take account of strategic as well as operational imperatives of an accredited degree in the context of a number of resource and other constraints typical of small island developing states. Intake, content and delivery were examined and the findings were used to guide the revision exercise. Associated interventions were assessed five years later. This paper provides an account of the considerations and process for the review and revision exercises. It discusses student performance and other indicators before and after the interventions; and examines the new curriculum against fit for purpose criteria alongside programming in best in class institutions and UK-based accreditation reference points. The paper closes with recommendations for ongoing review and revision cycles applicable to the Department at the UWI and other similarly situated institutions. © The Author(s) 2016.

AUTHOR KEYWORDS: Engineering mathematics; math curriculum; mathematics competency

DOCUMENT TYPE: Article

SOURCE: Scopus

Meletiou-Mavrotheris, M.a , Prodromou, T.b

Pre-Service Teacher Training on Game-Enhanced Mathematics Teaching and Learning

(2016) Technology, Knowledge and Learning, 21 (3), pp. 379-399.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84957566957&doi=10.1007%2fs10758-016-9275-y&partnerID=40&md5=40925f3af6ac36ac90e8de8c393bee16

DOI: 10.1007/s10758-016-9275-y

AFFILIATIONS: Department of Education Sciences, School of Arts and Education Sciences, European University Cyprus, 6 Diogenous St., Engomi, Nicosia, Cyprus;

Department of Mathematics Education, School of Education, University of New England, Armidale, NSW, Australia

ABSTRACT: The paper reports the main insights from a study aimed at equipping a group of pre-service teachers with the knowledge, skills, and practical experience required to effectively integrate educational games within the mathematics curriculum. An instructional intervention based on the Technological Pedagogical and Content Knowledge framework was implemented in an undergraduate mathematics methods course attended by thirteen (n = 13) prospective primary teachers. Participants experimented with different ways in which educational games could help students internalize key mathematical concepts across the primary curriculum, and were familiarized with the design principles for constructivist gaming environments. Upon completion of a unit on game-enhanced learning, they worked in small groups to develop and deliver, during their teaching placements, instructional episodes integrating the use of serious games. Findings indicate a positive impact on pre-service teachers’ perceptions regarding game-based learning, and on their competence in selecting, evaluating, and productively utilizing digital games as an instructional tool. © 2016, Springer Science+Business Media Dordrecht.

AUTHOR KEYWORDS: Educational games; Game-based learning; Game-enhanced learning; Pre-service teacher training; Serious games; Teacher professional development

DOCUMENT TYPE: Article

SOURCE: Scopus

Lee, N., Lee, L.W., Kovel, J.

An Experimental Study of Instructional Pedagogies to Teach Math-Related Content Knowledge in Construction Management Education

(2016) International Journal of Construction Education and Research, 12 (4), pp. 255-269.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84961204421&doi=10.1080%2f15578771.2016.1141440&partnerID=40&md5=63cfe743931844993bfeb7c27d6f981c

DOI: 10.1080/15578771.2016.1141440

AFFILIATIONS: Central Connecticut State University, New Britain, CT, United States

ABSTRACT: The capability for quantitative thought and expression is essential in the daily work of the construction industry. The National Association of State Directors of Career Technical Education Consortium (NASDCTEc) recognizes a keen understanding of mathematics as one of the most critical skills required in the construction management career field. Most construction management programs require students to take several prerequisite math courses. However, a high percentage of students have difficulty in applying their math skills to construction-related problems. The main question in this research was “what is the most effective pedagogical approach to helping students master the most needed math skills for construction management?” Three different instructional models (traditional lecture, problem-based learning, and flipped classroom) were compared to study improvement levels in student mastery of math skills. An experimental study was conducted in a state university. Fifty-two students were assigned to three groups. The same pre- and post-tests were performed in each group and the test results were measured and compared using analysis of variance (ANOVA) tests. Data analyses revealed that the problem-based learning approach produced the most improvement. This article also offers additional insight about that teaching method and student learning in construction management education. © 2016 Associated Schools of Construction.

AUTHOR KEYWORDS: Construction mathematics; instructional models; student-centered pedagogies

DOCUMENT TYPE: Article

SOURCE: Scopus

George Mwangi, C.A.a , Fries-Britt, S.b , Peralta, A.M.b , Daoud, N.b

Examining Intraracial Dynamics and Engagement Between Native-Born and Foreign-Born Black Collegians in STEM

(2016) Journal of Black Studies, 47 (7), pp. 773-794.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84986538889&doi=10.1177%2f0021934716658860&partnerID=40&md5=589ccdd7f67ac34fad2fb121c3ada365

DOI: 10.1177/0021934716658860

AFFILIATIONS: University of Massachusetts Amherst, United States;

University of Maryland, College Park, United States

ABSTRACT: For decades, higher education research has recognized the importance of cross-cultural interaction among students. However, this body of scholarship has largely examined this phenomenon across races, with few researchers examining within race interactions. Accordingly, the purpose of this study is to examine how native-born and foreign-born Black students interact in science, technology, engineering, and mathematics (STEM) classrooms. Findings reveal that there were both similarities and differences in how each group perceived each other, and that ultimately, cross-cultural engagement was beneficial for their academic development. © 2016, © The Author(s) 2016.

AUTHOR KEYWORDS: Black immigrants; Black students; cross-cultural; higher education; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Jagals, D.a , Van Der Walt, M.S.b

Exploiting metacognitive networks embedded in narrative focus group interviews using NodeXL

(2016) Qualitative Report, 21 (10), art. no. 2, pp. 1868-1880.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84992524383&partnerID=40&md5=1a160ff11a14d536d074e7e993189c3d

AFFILIATIONS: North West University, School for Education Studies, Faculty of Education Sciences, Potchefstroom, South Africa;

North West University, School for Curriculum-Based Studies, Mathematics Education’s, Faculty of Education Sciences, Potchefstroom, South Africa

ABSTRACT: Development of metacognitive theory for changing pedagogy remains an essential research activity. A lack of sufficient clear-cut qualitative analysis procedures extracting embedded metacognitive constructs from qualitative data (e.g., narrative focus group interviews) can hinder development of theory. An approach is therefore needed to analyse qualitative metacognitive data exploiting embedded metacognitive constructs for theory development. In an undergraduate fourth-year mathematics education module, two groups of students (Group A: n = 6; Group B: n = 5) participated in a series of focus group interviews. Participants designed and refined mathematics lessons about the concept of place value. We identified metacognitive networks as an embedded construct in students’ metacognitive processes. Findings indicate that metacognitive networks of an individual, social and socially shared metacognitive nature are embedded in qualitative data, and can be exploited to develop new metacognitive theory. We offer a novel three-step process in this methodology paper to extract metacognitive networks using Microsoft Office, ATLAS.ti and NodeXL. © 2016, Divan Jagals, Marthie Sophia Van der Walt, and Nova Southeastern University.

AUTHOR KEYWORDS: Focus groups; Metacognitive locale; Metacognitive networks; NodeXL; Qualitative research Methodology; Social network analysis

DOCUMENT TYPE: Article

SOURCE: Scopus

Koch, M., Gorges, T.

Curricular Influences on Female Afterschool Facilitators’ Computer Science Interests and Career Choices

(2016) Journal of Science Education and Technology, 25 (5), pp. 782-794.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84980047590&doi=10.1007%2fs10956-016-9636-2&partnerID=40&md5=75fdc8a35b75b3dad7586fccf4118fac

DOI: 10.1007/s10956-016-9636-2

AFFILIATIONS: SRI International, Menlo Park, CA, United States

ABSTRACT: Underrepresented populations such as women, African-Americans, and Latinos/as often come to STEM (science, technology, engineering, and mathematics) careers by less traditional paths than White and Asian males. To better understand how and why women might shift toward STEM, particularly computer science, careers, we investigated the education and career direction of afterschool facilitators, primarily women of color in their twenties and thirties, who taught Build IT, an afterschool computer science curriculum for middle school girls. Many of these women indicated that implementing Build IT had influenced their own interest in technology and computer science and in some cases had resulted in their intent to pursue technology and computer science education. We wanted to explore the role that teaching Build IT may have played in activating or reactivating interest in careers in computer science and to see whether in the years following implementation of Build IT, these women pursued STEM education and/or careers. We reached nine facilitators who implemented the program in 2011–12 or shortly after. Many indicated that while facilitating Build IT, they learned along with the participants, increasing their interest in and confidence with technology and computer science. Seven of the nine participants pursued further STEM or computer science learning or modified their career paths to include more of a STEM or computer science focus. Through interviews, we explored what aspects of Build IT influenced these facilitators’ interest and confidence in STEM and when relevant their pursuit of technology and computer science education and careers. © 2016, Springer Science+Business Media New York.

AUTHOR KEYWORDS: Computer science; Educative curriculum materials; Gender; STEM

DOCUMENT TYPE: Article

SOURCE: Scopus

Tíjaro-Rojas, R.a b , Arce-Trigatti, A.c , Cupp, J.d , Pascal, J.a , Arce, P.E.a

A Systematic and Integrative Sequence Approach (SISA) for mastery learning: Anchoring Bloom's Revised Taxonomy to student learning

(2016) Education for Chemical Engineers, 17, pp. 31-43. Cited 1 time.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84984684788&doi=10.1016%2fj.ece.2016.06.001&partnerID=40&md5=12edd32ecbb2ef455933a94f28a98f38

DOI: 10.1016/j.ece.2016.06.001

AFFILIATIONS: Chemical Engineering, Tennessee Technological University, Cookeville, TN, United States;

Environmental Engineering, Universidad Arturo Prat, Iquique, Chile;

College of Education, Health, and Human Science, University of Tennessee, Knoxville, TN, United States;

Counseling and Psychology, Tennessee Technological University, Cookeville, TN, United States

ABSTRACT: In this contribution, a methodical and student-based learning sequence entitled Systematic and Integrative Sequence Approach (SISA) is introduced. Primarily utilized within STEM disciplines, SISA is inspired by instructivist and constructivist approaches to learning and ultimately seeks to help students reach mastery learning levels regarding complex concepts within these fields. By organizing and anchoring lesson plans concerning these concepts to the cognitive objectives outlined by Bloom's Revised Taxonomy (Krathwohl, 2002), SISA facilitates students’ preparedness to contribute to the creation of technological developments and innovation in STEM fields. Offering an example of its application, this paper outlines how SISA has been integrated into the instruction of hydrodynamic velocity profiles in viscous flows. In addition, this effort highlights exploratory data collected from students taught by the SISA approach. Analysis of this study and implications for future work are also discussed. © 2016

AUTHOR KEYWORDS: Creativity in classroom; Innovation-driven learning; Integration of courses in engineering curricula; Integrative constructionism-instruction-based approaches; Revised Bloom Taxonomy; Team-based learning

DOCUMENT TYPE: Article

SOURCE: Scopus

Charlton, P., Avramides, K.

Knowledge Construction in Computer Science and Engineering when Learning Through Making

(2016) IEEE Transactions on Learning Technologies, 9 (4), art. no. 7740937, pp. 379-390.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007489100&doi=10.1109%2fTLT.2016.2627567&partnerID=40&md5=c3b0572ef27f0460daf0a4e663c379be

DOI: 10.1109/TLT.2016.2627567

AFFILIATIONS: UCL Knowledge Lab, University College London, Emerald Street, London, United Kingdom

ABSTRACT: This paper focuses on a design based research study about STEM (Science, Technology, Engineering and Maths) learning by making through collaboration and production. This study examines learning by making by students to explore STEM using a constructionist approach with a particular focus on computer science and engineering. The use of IoT as a technology enhanced learning (TEL) tool created the learning conditions to be studied: (a) collaborative: no one person had the knowledge to complete the project alone, (b) problem-based: no off the shelf solution was used, and (c) multidisciplinary: the learning context pushed the boundaries across the subjects. The study investigated the learning conditions and indicators of collaboration and production taking place when learning about STEM. The results were used to inform the design of effective data analytics and visualization tools for the PELARS project to advance practice-based learning activities in STEM teaching. However, more specifically, the findings provide insight into the knowledge construction process when learning through making in complex environments. These insights illustrate the combined pedagogical value of collaboration and production supporting the multidisciplinary learning opportunities. The importance of community knowledge construction and its relationship to the pedagogical approach is examined. The significance of these findings in the context of IoT TEL tools in education is explored. © 2008-2011 IEEE.

AUTHOR KEYWORDS: Collaborative and problem-based learning; computer science; engineering; internet of things; knowledge construction; learner-centered design; learning indicators; STEM; technology enhanced learning

DOCUMENT TYPE: Article

SOURCE: Scopus

Bozick, R.a , Srinivasan, S.b , Gottfried, M.c

Do high school STEM courses prepare non-college bound youth for jobs in the STEM economy?

(2016) Education Economics, pp. 1-17. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84989235483&doi=10.1080%2f09645292.2016.1234585&partnerID=40&md5=8c4aa6a3252c6d8da59ff819bbd210f7

DOI: 10.1080/09645292.2016.1234585

AFFILIATIONS: RAND Corporation, Santa Monica, CA, USA;

Economic Commission for Latin America and the Caribbean, Santiago, Chile;

Gevirtz Graduate School of Education, University of California–Santa Barbara, Santa Barbara, CA, USA

ABSTRACT: Our study assesses whether high school science, technology, engineering, and mathematics (STEM) courses provide non-college bound youth with the skills and training necessary to successfully transition from high school into the STEM economy. Specifically, our study estimates the effects that advanced math, advanced science, engineering, and computer science courses in high school have on the probability that non-college bound youth will obtain employment in the STEM economy and on wages within two years of graduating from high school. Our findings indicate that STEM coursework is unrelated with the probability of securing a job in the STEM economy and is unrelated with wages two years post high school graduation. © 2016 Informa UK Limited, trading as Taylor & Francis Group

AUTHOR KEYWORDS: school-to-work; STEM; vocational education

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Miller, B.G.a , Roehrig, G.b

Indigenous cultural contexts for STEM experiences: snow snakes’ impact on students and the community

(2016) Cultural Studies of Science Education, pp. 1-28. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84988419470&doi=10.1007%2fs11422-016-9738-4&partnerID=40&md5=234c68ea0798eddfc5ac2fbecb9c7e92

DOI: 10.1007/s11422-016-9738-4

AFFILIATIONS: Department of Curriculum and Instruction, University of Idaho, 875 Perimeter Dr., Moscow, ID, United States;

University of Minnesota, St. Paul, United States

ABSTRACT: Opportunities for American Indian youth to meaningfully engage in school-based science, technology, engineering, and mathematics (STEM) experiences have historically been inadequate. As a consequence, American Indian students perform lower on standardized assessments of science education than their peers. In this article we describe the emergence of meaning for students—as well as their community—resulting from Indigenous culturally-based STEM curriculum that used an American Indian tradition as a focal context. Specifically, the game of snow snakes (Gooneginebig in Ojibwe) afforded an opportunity for STEM and culturally-based resources to work in unison. A case study research design was used with the bounded case represented by the community associated with the snow snake project. The research question guiding this study was: What forms of culturally relevant meaning do students and the community form as a result of the snow snake game? Results indicate evidence of increased student and community engagement through culturally-based STEM experiences in the form of active participation and the rejuvenation of a traditional game. Implications are discussed for using culturally-based contexts for STEM learning. © 2016 Springer Science+Business Media Dordrecht

AUTHOR KEYWORDS: Community; Culturally-based; Curriculum; Engagement; Snow snakes; STEM

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Barmpoutis, A.a , Ding, Q.a , Anthony, L.b , Eugene, W.b , Suvajdzic, M.a

Exploration of kinesthetic gaming for enhancing elementary math education using culturally responsive teaching methodologies

(2016) 2016 IEEE Virtual Reality Workshop on K-12 Embodied Learning through Virtual and Augmented Reality, KELVAR 2016, art. no. 7563674, pp. 1-4.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84994403141&doi=10.1109%2fKELVAR.2016.7563674&partnerID=40&md5=b733edf351d8edb5336941ed980e966a

DOI: 10.1109/KELVAR.2016.7563674

AFFILIATIONS: Digital Worlds Institute, University of Florida, United States;

Computer and Information Science and Engineering, University of Florida, United States

ABSTRACT: In this paper a novel computer-assisted culturally responsive teaching (CRT) framework is presented for teaching mathematics to 5th grade students. The curricular basis for this framework is Gloria Jean Merriex's award winning curriculum program, which uses music and body gestures to help students build associations between mathematical concepts and culturally inspired metaphors. The proposed framework uses low-cost kinesthetic sensors along with a embodied virtual reality gamimg environment that extends such proven CRT methodologies from a traditional classroom into a digital form. A pilot study was performed to investigate the efficacy of this framework in 5th grade students. A group of 35 students participated in this study and the results are discussed in detail. © 2016 IEEE.

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Saber, H.A.

Using maple, maple 3D graphics, and tablet PC to teach calculus II and III

(2016) 2016 13th Learning and Technology Conference, L and T 2016, art. no. 7562864, pp. 45-50.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84991253023&doi=10.1109%2fLT.2016.7562864&partnerID=40&md5=60cf1b23aea4d2bc2e116274fc58ea60

DOI: 10.1109/LT.2016.7562864

AFFILIATIONS: Department of Mathematics, University of North Georgia, Gainesville, GA, United States

ABSTRACT: This paper presents a project that is in its preliminary stage at the University of North Georgia, which aims to efficiently increase student engagement and support teachers' instructional needs. The ultimate goal of the project is to create engaging math learning models that will make the learning environment fun and attractive. The main goal of the project is to develop effective math learning models and use them to enhance students' performance. By applying Maple, a cutting-edge Computer Algebra Systems (CAS), and other digital tools (Tablet PC's) for teaching and learning of mathematics, these models can: (1) make mathematics learning interesting and meaningful while still covering the original contents; (2) simplify abstract mathematics concepts and make them easy to understand; and (3) bridge mathematics and science and motivate students to seek science careers. In class room we use Microsoft OneNote on the Tablet PC and combine it with a Digital Projector. Maple 3D graphs are easily imported to class notes and we can archive and share our lecture notes. The models are carefully designed to provide students with the chance to explore mathematical issues that are infeasible to address in the classroom and improve their performance in mathematics and prepare them to for advanced science and engineering courses. The model also balances this capability by allowing students to modify selected parts of the MPLE worksheet for a given problem and guide them to design new procedure, and are thus get them to use Maple features to perform application tasks. We also explore whether using these tools will positively affect student engagement in the classroom in addition to aiding them in the long term development of a deep conceptual understanding of mathematics. © 2016 IEEE.

AUTHOR KEYWORDS: Calculus; Effective Student Engagement; Maple 3D Graphics; Tablet PC's

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

Garibay, J.C., Vincent, S.

Racially Inclusive Climates Within Degree Programs and Increasing Student of Color Enrollment: An Examination of Environmental/Sustainability Programs

(2016) Journal of Diversity in Higher Education, . Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84984923487&doi=10.1037%2fdhe0000030&partnerID=40&md5=25095ccf9a990bacecf14fdcc462b3d0

DOI: 10.1037/dhe0000030

AFFILIATIONS: Dummy Address

ABSTRACT: Students of color remain severely underrepresented in many science, technology, engineering, and mathematics (STEM) disciplines, including environmental fields. Although there is a growing body of research on predictors of selecting a STEM major, generally, much less is know about factors, especially at the program level, that predict the enrollment of students of color into specific STEM degree programs. Additionally, theoretical frameworks and higher education research on college major choice have yet to consider whether the climate for racial/ethnic diversity specifically within academic degree programs may affect the enrollment of students of color in those programs. Given this theoretical and empirical gap, this study set out to investigate whether an inclusive climate for diversity within a degree program may contribute to an increasing enrollment of students of color in interdisciplinary environmental and sustainability (IES) degree programs. Using a national sample of 343 IES degree programs and extending dimensions of an inclusive campus climate for racial/ethnic diversity to degree programs, findings show that IES degree programs with a more inclusive curriculum and greater student compositional diversity are significantly more likely to report an increasing enrollment of students of color. Implications of the findings for broadening participation and understanding diverse students' college major/career choice are examined. (PsycINFO Database Record (c) 2016 APA, all rights reserved).

AUTHOR KEYWORDS: Broadening participation; Climate for racial/ethnic diversity; College major choice; STEM; Students of color

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Bhathal, R.

An appraisal of an online tutorial system for the teaching and learning of engineering physics in conjunction with contextual physics and mathematics, and relevant mathematics

(2016) European Journal of Engineering Education, 41 (5), pp. 504-511.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84945242227&doi=10.1080%2f03043797.2015.1095162&partnerID=40&md5=97085bfc001831b4bc9539196a1cb7b5

DOI: 10.1080/03043797.2015.1095162

AFFILIATIONS: School of Computing, Engineering and Mathematics, University of Western Sydney, Penrith, Australia

ABSTRACT: The number of students entering engineering schools in Australian universities has increased tremendously over the last few years because of the Australian Federal Government's policy of increasing the participation rates of Higher School Certificate students and students from low social economic status backgrounds in the tertiary sector. They now come with a diverse background of skills, motivations and prior knowledge. It is imperative that new methods of teaching and learning be developed. This paper describes an online tutorial system used in conjunction with contextual physics and mathematics, and the revision of the relevant mathematical knowledge at the appropriate time before a new topic is introduced in the teaching and learning of engineering physics. Taken as a whole, this study shows that students not only improved their final examination results but there was also an increase in the retention rate of first-year engineering students which has financial implications for the university. © 2015 SEFI.

AUTHOR KEYWORDS: Active learning; blended learning; contextual physics and mathematics; MasteringPhysics (MP); online learning; relevant mathematics

DOCUMENT TYPE: Article

SOURCE: Scopus

Staffas, K.

Heuristic for learning common emitter amplification with bipolar transistors

(2016) European Journal of Engineering Education, pp. 1-15. Article in Press.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84984674622&doi=10.1080%2f03043797.2016.1226782&partnerID=40&md5=33e2882c01a276ea00e2d60fafddbc17

DOI: 10.1080/03043797.2016.1226782

AFFILIATIONS: Department of Engineering Sciences, Uppsala University, Uppsala, Sweden

ABSTRACT: Mathematics in engineering education causes many thresholds in the courses because of the demand of abstract conceptualisation. Electronics depend heavily on more or less complex mathematics. Therefore the concepts of analogue electronics are hard to learn since a great deal of students struggle with the calculations and procedures needed. A survey was done focusing on students’ struggle to pass a course in analogue electronics by introducing a top-down perspective and the revised taxonomy of Bloom. From a top-down perspective you can create learning environments from any spot in the taxonomy using a step-by-step approach of the verbs understand and apply. Three textbooks with a top-down perspective on analogue electronics are analysed on the concept of amplifying with a transistor circuit. The study claims issues when losing the top-down perspective to present concepts and procedures of the content to be learned. © 2016 SEFI

AUTHOR KEYWORDS: deep and surface learning; facts; heuristic; procedural and conceptual knowledge; Top-down

DOCUMENT TYPE: Article in Press

SOURCE: Scopus

Foshee, C.M.a , Elliott, S.N.b , Atkinson, R.K.b

Technology-enhanced learning in college mathematics remediation

(2016) British Journal of Educational Technology, 47 (5), pp. 893-905.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84928740210&doi=10.1111%2fbjet.12285&partnerID=40&md5=9b2a1c65bd2a43c681bb4218bc7cc238

DOI: 10.1111/bjet.12285

AFFILIATIONS: Cleveland Clinic Foundation, Cleveland Clinic Lerner College of Medicine of Case Western University, United States;

Arizona State University, United States

ABSTRACT: US colleges presently face an academic plight; thousands of high school graduates are performing below the expected ability for college-level mathematics. This paper describes an innovative approach intended to improve the mathematics performance of first-year college students, at a large US university. The innovation involved the integration of faculty-led instruction with technology-enhanced learning (TEL). In this case, TEL refers to a sophisticated software program that delivers mathematics education using an adaptive, self-paced, individualized, mastery-based approach. The purpose of this investigation was to examine the extent to which TEL met the educational requirements of college students in need of remediation and to explore the effects of TEL on students' beliefs about their academic ability and academic behaviors (academic competence). The sample of 2880 included all the students enrolled in a single semester of remedial mathematics. Results suggested successful remediation, as indicated by the end-of-semester course completion rate, with 75% of students eligible to enroll in a first-year sequence mathematics course and an additional 18% on track for eligibility by the following semester. TEL also appeared to have a positive, statistically significant effect on students' learning and academic competence. For these findings, we discuss study limitations and implications for future research. © 2015 British Educational Research Association

DOCUMENT TYPE: Article

SOURCE: Scopus

Kirwan, L., Hall, K.

The mathematics problem: the construction of a market-led education discourse in the Republic of Ireland

(2016) Critical Studies in Education, 57 (3), pp. 376-393.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84945319319&doi=10.1080%2f17508487.2015.1102752&partnerID=40&md5=57a740ad19ddc3a17742aecb3260cd93

DOI: 10.1080/17508487.2015.1102752

AFFILIATIONS: School of Education, University College Cork, Cork, Ireland

ABSTRACT: Educational change in the neoliberal state is permeated by the effects of forces from outside the field of education itself. The process of governmentality welcomes, indeed demands, the participation of those non-state actors valorised by neoliberalism as well as government agencies dedicated to the advancement of such groups. Inevitably, the concerns of such organisations become central to how the state sees education. This article traces the assembly of national and international agents from industry, business and special interest groups around the concept of ‘knowledge economy’. It treats this assemblage as an apparatus (dispositif), examining how the construction of an economic problem is brought to bear on the demand for educational change, and how this construction of the problem is used to shape public opinion in order to prepare the public for a radical change of direction. Confining itself to the reform of mathematics education introduced in the Republic of Ireland in 2010, this article traces the emergence of a mathematics discourse focused on market-led education. It interrogates the construction of ‘the mathematics problem’ or ‘crisis in maths’ and argues that the discourse of the present construction is economic in nature, centring as it does on human capital production and market-led reform. © 2015 Informa UK Limited, trading as Taylor & Francis Group.

AUTHOR KEYWORDS: governmentality; human capital; Ireland; knowledge economy; market-led education; mathematics education; neoliberalism; Project Maths

DOCUMENT TYPE: Article

SOURCE: Scopus

Asai, D.J.a , Bauerle, C.a b

From HHMI: Doubling down on diversity

(2016) CBE Life Sciences Education, 15 (3), art. no. fe6, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84986575981&doi=10.1187%2fcbe.16-01-0018&partnerID=40&md5=9b3b70528be202a9126f786c8cd700d5

DOI: 10.1187/cbe.16-01-0018

AFFILIATIONS: Undergraduate and Graduate Science Education Programs, Howard Hughes Medical Institute, Chevy Chase, MD, United States;

College of Science and Mathematics, James Madison University, Harrisonburg, VA, United States

ABSTRACT: In spite of modest gains in the past four decades, the United States has not been able to substantially improve on the pervasive underrepresentation of minorities in postsecondary science, technology, engineering, and mathematics (STEM) pathways. We suggest a way to guide a national effort to double the persistence of underrepresented minorities in STEM in the next decade. © 2016 D. J. Asai and C. Bauerle.

DOCUMENT TYPE: Article

SOURCE: Scopus

Wake, G.

Mathematics, modelling and students in transition

(2016) Teaching Mathematics and its Applications, 35 (3), pp. 172-186.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995755348&doi=10.1093%2fteamat%2fhrw015&partnerID=40&md5=d4dd979b5949ea509252b6e5f3f731e9

DOI: 10.1093/teamat/hrw015

AFFILIATIONS: Centre for Research in Mathematics Education, University of Nottingham, Jubilee Campus, Nottingham, United Kingdom

ABSTRACT: This article is based on data from two major research projects that investigated students involved in mathematically demanding courses during their transition through college and into university. It explores the nature of modelling as a mathematical practice in this important transition phase for students. Theoretical considerations are informed by illustrative accounts of a college mathematical modelling lesson and engineering lecture exemplifying the complex nature of mathematical modelling in these two phases of post-compulsory education. This raises important issues concerning the teaching and learning of mathematical practices in relation to modelling and applications. The discussion presented here is seen through the lens of Cultural Historical Activity Theory that informed the project team 's analysis of the case studies developed of both institutions and individuals. In this article, data and earlier findings are reinterpreted to better understand how we might support students as they move from learning mathematics to learning to use mathematics effectively in pursuit of their other studies. The accounts of classroom and lecture activity illustrate how 'doing mathematics' is mediated in different ways ensuring that students experience modelling and applications as mathematical practices very differently in each. This leads me to explain why, but also infer that students are likely to experience difficulties in transition both 'vertically' in progression from one activity system to another over time (college to higher education) and 'horizontally' between activity systems in which they participate concurrently (maths and engineering classes in university). © The Author 2016.

DOCUMENT TYPE: Article

SOURCE: Scopus

James, S.M.a , Singer, S.R.b

From the NSF: The National Science Foundation's Investments in Broadening Participation in Science, Technology, Engineering, and Mathematics Education through Research and Capacity Building

(2016) CBE life sciences education, 15 (3), .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013176242&doi=10.1187%2fcbe.16-01-0059&partnerID=40&md5=6217463b3461d976438271d1345bfe12

DOI: 10.1187/cbe.16-01-0059

AFFILIATIONS: Division of Human Resource Development, Directorate for Education and Human Resources, National Science Foundation, Arlington, VA 22230;

Biology and Cognitive Science Departments, Carleton College, Northfield, MN 55057 Division of Undergraduate Education, Directorate for Education and Human Resources, National Science Foundation, Arlington, VA 22230 srsinger@rollins.edu

ABSTRACT: The National Science Foundation (NSF) has a long history of investment in broadening participation (BP) in science, technology, engineering, and mathematics (STEM) education. A review of past NSF BP efforts provides insights into how the portfolio of programs and activities has evolved and the broad array of innovative strategies that has been used to increase the participation of groups underrepresented in STEM, including women, minorities, and persons with disabilities. While many are familiar with these long-standing programmatic efforts, BP is also a key component of NSF's strategic plans, has been highlighted in National Science Board reports, and is the focus of ongoing outreach efforts. The majority of familiar BP programs, such as the Louis Stokes Alliances for Minority Participation (now 25 years old), are housed in the Directorate for Education and Human Resources. However, fellowship programs such as the Graduate Research Fellowships and Postdoctoral Research Fellowships under the Directorate for Biological Sciences (and parallel directorates in other STEM disciplines) are frequently used to address underrepresentation in STEM disciplines. The FY2016 and FY2017 budget requests incorporate funding for NSF INCLUDES, a new cross-agency BP initiative that will build on prior successes while addressing national BP challenges. NSF INCLUDES invites the use of innovative approaches for taking evidence-based best practices to scale, ushering in a new era in NSF BP advancement. © 2016 S. M. James and S. R. Singer. CBE—Life Sciences Education © 2016 The American Society for Cell Biology. This article is distributed by The American Society for Cell Biology under license from the author(s). It is available to the public under an Attribution–Noncommercial–Share Alike 3.0 Unported Creative Commons License (http://creativecommons.org/licenses/by-nc-sa/3.0).

DOCUMENT TYPE: Article

SOURCE: Scopus

Harris, D., Pampaka, M.

"They [the lecturers] have to get through a certain amount in an hour": First year students' problems with service mathematics lectures

(2016) Teaching Mathematics and its Applications, 35 (3), pp. 144-158.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84995804515&doi=10.1093%2fteamat%2fhrw013&partnerID=40&md5=82a7c471bffe477a9666cccd2c7d3b6e

DOI: 10.1093/teamat/hrw013

AFFILIATIONS: Manchester Institute of Education, University of Manchester, Ellen Wilkinson Building, Manchester, United Kingdom

ABSTRACT: Drawing on large-scale survey data and interviews with students during their first year at university, and case studies in their institutions, we explore the problems faced by students taking mathematically demanding courses, e.g. physics and engineering. These students are often taught mathematics as a service subject by lecturers of mathematics. Analysis of students' perceptions of transition suggests that "the lecture" in Higher Education continues to pose problems. Thematic analysis of interview data shows that these problems relate to the way lectures involve 'time pressure' and 'lack of dialogue/interaction' which are practices that we associate with transmissionist pedagogy generally and can also create negative dispositions. A case study of one mathematics course for engineering that we argue made a difference is presented, and conclusions drawn for developing practice which are especially pertinent with the introduction of the Teaching Excellence Framework to monitor and assess teaching in universities. © The Author 2016.

DOCUMENT TYPE: Article

SOURCE: Scopus

Lane, T.B.

Beyond academic and social integration: Understanding the impact of a STEM enrichment program on the retention and degree attainment of underrepresented students

(2016) CBE Life Sciences Education, 15 (3), art. no. ar39, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84983296771&doi=10.1187%2fcbe.16-01-0070&partnerID=40&md5=44e5c6b339fc557c2621523b748d5f02

DOI: 10.1187/cbe.16-01-0070

AFFILIATIONS: Department of Leadership, Counseling Adult Career and Higher Education, University of South Florida, Tampa, FL, United States

ABSTRACT: The current study used a case study methodological approach, including document analysis, semistructured interviews, and participant observations, to investigate how a science, technology, engineering, and mathematics (STEM) enrichment program supported retention and degree attainment of underrepresented students at a large, public, predominantly white institution. From this study, a model emerged that encompassed four components: proactive care, holistic support, community building, and catalysts for STEM identity development. These components encompassed a number of strategies and practices that were instrumental in the outcomes of program participants. This paper concludes with implications for practice, such as using models to inform program planning, assessment, and evaluation. © 2016 T. B. Lane.

DOCUMENT TYPE: Article

SOURCE: Scopus

James, S.M.a , Singer, S.R.b c

From the NSF: The national science foundation’s investments in broadening participation in science, technology, engineering, and mathematics education through research and capacity building

(2016) CBE Life Sciences Education, 15 (3), art. no. fe7, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84986551092&doi=10.1187%2fcbe.16-01-0059&partnerID=40&md5=a1ed4d8f537cb808c7ccc6d3cde1ef83

DOI: 10.1187/cbe.16-01-0059

AFFILIATIONS: Division of Human Resource Development, Directorate for Education and Human Resources, National Science Foundation, Arlington, VA, United States;

Biology and Cognitive Science Departments, Carleton College, Northfield, MN, United States;

Division of Undergraduate Education, Directorate for Education and Human Resources, National Science Foundation, Arlington, VA, United States

ABSTRACT: The National Science Foundation (NSF) has a long history of investment in broadening participation (BP) in science, technology, engineering, and mathematics (STEM) education. A review of past NSF BP efforts provides insights into how the portfolio of programs and activities has evolved and the broad array of innovative strategies that has been used to increase the participation of groups underrepresented in STEM, including women, minorities, and persons with disabilities. While many are familiar with these long-standing programmatic efforts, BP is also a key component of NSF’s strategic plans, has been highlighted in National Science Board reports, and is the focus of ongoing outreach efforts. The majority of familiar BP programs, such as the Louis Stokes Alliances for Minority Participation (now 25 years old), are housed in the Directorate for Education and Human Resources. However, fellowship programs such as the Graduate Research Fellowships and Postdoctoral Research Fellowships under the Directorate for Biological Sciences (and parallel directorates in other STEM disciplines) are frequently used to address underrepresentation in STEM disciplines. The FY2016 and FY2017 budget requests incorporate funding for NSF INCLUDES, a new cross-agency BP initiative that will build on prior successes while addressing national BP challenges. NSF INCLUDES invites the use of innovative approaches for taking evidence- based best practices to scale, ushering in a new era in NSF BP advancement. © 2016 S. M. James and S. R. Singer.

DOCUMENT TYPE: Article

SOURCE: Scopus

Metcalf, H.

Broadening the study of participation in the life sciences: How critical theoretical and mixed-methodological approaches can enhance efforts to broaden participation

(2016) CBE Life Sciences Education, 15 (3), art. no. rm3, . Cited 1 time.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84982135140&doi=10.1187%2fcbe.16-01-0064&partnerID=40&md5=be22fe222e16127a1afb0b2f1321a812

DOI: 10.1187/cbe.16-01-0064

AFFILIATIONS: Association for Women in Science, Alexandria, VA, United States

ABSTRACT: This research methods Essay details the usefulness of critical theoretical frameworks and critical mixed-methodological approaches for life sciences education research on broadening participation in the life sciences. First, I draw on multidisciplinary research to discuss critical theory and methodologies. Then, I demonstrate the benefits of these approaches for researchers who study diversity and inclusion issues in the life sciences through examples from two critical mixed-methods studies of prominent issues in science, technology, engineering, and mathematics (STEM) participation and recognition. The first study pairs critical discourse analysis of the STEM workforce literature, data, and underlying surveys with quantitative analyses of STEM pathways into the workforce. This example illustrates the necessity of questioning popular models of retention. It also demonstrates the importance of intersecting demographic categories to reveal patterns of experience both within and between groups whose access to and participation in STEM we aim to improve. The second study’s critical approach applies research on inequities in prizes awarded by STEM professional societies toward organizational change. This example uses data from the life sciences professional societies to show the importance of placing data within context to broaden participation and understand challenges in creating sustainable change. © 2016 H. Metcalf. CBE—Life Sciences Education.

DOCUMENT TYPE: Article

SOURCE: Scopus

Killpack, T.L.a , Melón, L.C.b

Toward inclusive STEM classrooms: What personal role do faculty play?

(2016) CBE Life Sciences Education, 15 (3), art. no. es3, 9 p. Cited 1 time.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84982881451&doi=10.1187%2fcbe.16-01-0020&partnerID=40&md5=af381bda346fe105aec773eefb3450fb

DOI: 10.1187/cbe.16-01-0020

AFFILIATIONS: Department of Biological Sciences, Wellesley College, Wellesley, MA, United States;

Department of Neuroscience, Tufts University School of Medicine, Boston, MA, United States

ABSTRACT: Private and public policies are increasingly aimed at supporting efforts to broaden participation of a diverse body of students in higher education. Unfortunately, this increase in student diversity does not always occur alongside changes in institutional culture. Unexamined biases in institutional culture can prevent diverse students from thriving and persisting in science, technology, engineering, and mathematics (STEM) fields. Given the daily personal interactions that faculty have with students, we suggest that individual educators have the opportunity, and responsibility, to improve the retention and persistence of diverse students. However, in our experience, faculty professional development programs often limit discussions of diversity to “comfortable” topics (such as learning styles) and miss opportunities to explore deeper issues related to faculty privilege, implicit bias, and cues for stereotype threat that we all bring to the classroom. In this essay, we present a set of social science concepts that we can extend to our STEM courses to inform our efforts at inclusive excellence. We have recommended strategies for meaningful reflection and professional development with respect to diversity and inclusion, and aim to empower faculty to be change agents in their classrooms as a means to broadening participation in STEM fields. © 2016 T. L. Killpack and L. C. Melón. CBE—Life Sciences Education.

DOCUMENT TYPE: Article

SOURCE: Scopus

Choy, B.H.

Snapshots of mathematics teacher noticing during task design

(2016) Mathematics Education Research Journal, 28 (3), pp. 421-440.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84985916518&doi=10.1007%2fs13394-016-0173-3&partnerID=40&md5=257b9151e25ec68a81b60e03aecfe11a

DOI: 10.1007/s13394-016-0173-3

AFFILIATIONS: National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, Singapore, Singapore

ABSTRACT: Designing a mathematically worthwhile task is critical for promoting students’ reasoning. To improve task design skills, teachers often engage in collaborative lesson planning activities such as lesson study. However, to learn from the process of lesson study, it is important for teachers to notice productively the concepts, students’ confusion and the design of the task. But what researchers mean by productive noticing varies. In this article, I present the FOCUS Framework which highlights two characteristics of productive noticing: having an explicit focus for noticing and focusing noticing through pedagogical reasoning. Using these two characteristics, I develop snapshots of noticing as a representation of practice to present a fine-grained analysis of teacher noticing. Through vignettes of teachers discussing the design of a task to teach fractions, I illustrate how two teachers’ noticing can be analysed and represented using snapshots of noticing. To conclude, I highlight what snapshots of noticing tell us about a teacher’s noticing and suggest ways to use these snapshots in future studies of noticing. © 2016, Mathematics Education Research Group of Australasia, Inc.

AUTHOR KEYWORDS: Fractions; Mathematics teacher noticing; Productive teaching practices; Representations of practice; Task design

DOCUMENT TYPE: Article

SOURCE: Scopus

Levashenko, V., Zaitseva, E., Kostolny, J., Kvassay, M.

Educational portal with data mining support based on modern technologies

(2015) ICETA 2015 - 13th IEEE International Conference on Emerging eLearning Technologies and Applications, Proceedings, art. no. 7558490, .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84990888174&doi=10.1109%2fICETA.2015.7558490&partnerID=40&md5=9d802c26b4fd0ddc9b15ae131d21d6e1

DOI: 10.1109/ICETA.2015.7558490

AFFILIATIONS: University of Zilina, Department of Informatics, Zilina, Slovakia

ABSTRACT: Computers and internet connection are now common equipment in households. However, computer games have become an obstacle in education because pupils spend time needed for education and relax by playing games. One of the possible solutions of this problem is a creation of attractive education programs in the form of computer games. Such programs will be attractive for children and will introduce them into taught subjects. In this paper, the concept, design and structure of an attractive virtual educational portal is presented. The Portal is tailored to the interests of pupils of primary schools, and it is oriented to support solving school homework using the attractive approach in the form of computer game. Furthermore, a method for intelligent analysis of pupils' progress in the learning is also proposed in this paper. The method is based on fuzzy decision trees, which represent one of the modern approaches in data mining. © 2015 IEEE.

DOCUMENT TYPE: Conference Paper

SOURCE: Scopus

DiBartolo, P.M.a , Gregg-Jolly, L.b , Gross, D.c , Manduca, C.A.d , Iverson, E.e , Cooke, D.B., 3rdf , Davis, G.K.g , Davidson, C.h , Hertz, P.E.i , Hibbard, L.j , Ireland, S.K.k , Mader, C.l , Pai, A.m , Raps, S.n , Siwicki, K.o , Swartz, J.E.p

Principles and Practices Fostering Inclusive Excellence: Lessons from the Howard Hughes Medical Institute's Capstone Institutions

(2016) CBE life sciences education, 15 (3), .

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013155676&doi=10.1187%2fcbe.16-01-0028&partnerID=40&md5=0c1814915b0677b7e05789f975bf416e

DOI: 10.1187/cbe.16-01-0028

AFFILIATIONS: Clark Science Center, Smith College, Northampton, MA 01063 pdibarto@smith.edu;

Department of Biology, Grinnell College, Grinnell, IA 50112;

Department of Chemistry, Carleton College, Northfield, MN 55057;

Science Education Resource Center, Carleton College, Northfield, MN 55057;

Science Education Resource Center, Carleton College, Northfield, MN 55057;

Department of Biology, Morehouse College, Atlanta, GA 30314;

Department of Biology, Bryn Mawr College, Bryn Mawr, PA 19010;

Department of Geology, Carleton College, Northfield, MN 55057;

Department of Biology, Barnard College, New York, NY 10027;

Department of Chemistry and Biochemistry, Spelman College, Atlanta, GA 30314;

Department of Biology, Xavier University of Louisiana, New Orleans, LA 70125;

Department of Physics, Hope College, Holland, MI 49422;

Department of Biology, Spelman College, Atlanta, GA 30314;

Department of Biological Sciences, Hunter College, New York, NY 10065;

Department of Biology, Swarthmore College, Swarthmore, PA 19081;

Department of Chemistry, Grinnell College, Grinnell, IA 50112

ABSTRACT: Best-practices pedagogy in science, technology, engineering, and mathematics (STEM) aims for inclusive excellence that fosters student persistence. This paper describes principles of inclusivity across 11 primarily undergraduate institutions designated as Capstone Awardees in Howard Hughes Medical Institute's (HHMI) 2012 competition. The Capstones represent a range of institutional missions, student profiles, and geographical locations. Each successfully directed activities toward persistence of STEM students, especially those from traditionally underrepresented groups, through a set of common elements: mentoring programs to build community; research experiences to strengthen scientific skill/identity; attention to quantitative skills; and outreach/bridge programs to broaden the student pool. This paper grounds these program elements in learning theory, emphasizing their essential principles with examples of how they were implemented within institutional contexts. We also describe common assessment approaches that in many cases informed programming and created traction for stakeholder buy-in. The lessons learned from our shared experiences in pursuit of inclusive excellence, including the resources housed on our companion website, can inform others' efforts to increase access to and persistence in STEM in higher education. © 2016 P. M. DiBar et al. CBE—Life Sciences Education © 2016 The American Society for Cell Biology. This article is distributed by The American Society for Cell Biology under license from the author(s). It is available to the public under an Attribution–Noncommercial–Share Alike 3.0 Unported Creative Commons License (http://creativecommons.org/licenses/by-nc-sa/3.0).

DOCUMENT TYPE: Article

SOURCE: Scopus

Drew, J.C., Galindo-Gonzalez, S., Ardissone, A.N., Triplett, E.W.

Broadening participation of women and underrepresented minorities in STEM through a hybrid online transfer program

(2016) CBE Life Sciences Education, 15 (3), art. no. ar50, .

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DOI: 10.1187/cbe.16-01-0065

AFFILIATIONS: Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL, United States

ABSTRACT: The Microbiology and Cell Science (MCS) Department at the University of Florida (UF) developed a new model of a 2 + 2 program that uses a hybrid online approach to bring its science, technology, engineering, and mathematics (STEM) curriculum to students. In this paradigm, 2-year graduates transfer as online students into the Distance Education in MCS (DE MCS) bachelor of science program. The program has broadened access to STEM with a steadily increasing enrollment that does not draw students away from existing on-campus programs. Notably, half of the DE MCS students are from underrepresented minority (URM) backgrounds and two-thirds are women, which represents a greater level of diversity than the corresponding on-campus cohort and the entire university. Additionally, the DE MCS cohort has comparable retention and academic performance compared with the on-campus transfer cohort. Of those who have earned a BS through the DE MCS program, 71% are women and 61% are URM. Overall, these data demonstrate that the hybrid online approach is successful in increasing diversity and provides another viable route in the myriad of STEM pathways. As the first of its kind in a STEM field, the DE MCS program serves as a model for programs seeking to broaden their reach. © 2016 J. C. Drew et al.

DOCUMENT TYPE: Article

SOURCE: Scopus

Thompson, R.C.a , Monroe-White, T.c , Xavier, J.d , Howell, C.c , Moore, M.R.a , Haynes, J.K.b

Preparation of underrepresented males for scientific careers: A study of the Dr. John H. Hopps Jr. defense research scholars program at morehouse college

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DOI: 10.1187/cbe.15-12-0263

AFFILIATIONS: Hopps Defense Research Scholars Program, Morehouse College, Atlanta, Georgia;

Department of Biology, Morehouse College, Atlanta, Georgia;

SageFox Consulting Group, Atlanta, Georgia;

SageFox Consulting Group, Amherst, MA, United States

ABSTRACT: Equal representation within higher education science, technology, engineering, and mathematics (STEM) fields and the STEM workforce in the United States across demographically diverse populations is a long-standing challenge. This study uses two-to-one nearest- neighbor matched-comparison group design to examine academic achievement, pursuit of graduate science degree, and classification of graduate institution attended by students participating in the Hopps Scholars Program (Hopps) at Morehouse College. Hopps is a highly structured enrichment program aimed at increasing participation of black males in STEM fields. Morehouse institutional records, Hopps Program records, and National Student Clearinghouse data were used to examine differences between Hopps and non-Hopps STEM graduates of Morehouse. Two-way sample t tests and chi-square tests revealed significant differences in academic achievement, likelihood of STEM degree pursuit, and the classification of graduate institutions attended by Hopps versus non-Hopps students. Hopps Scholars were significantly more likely than non-Hopps STEM graduates both to pursue STEM doctoral degrees and to attend doctoral-granting institutions with higher research activity. The Hopps Program’s approach to training black male students for scientific careers is a model of success for other programs committed to increasing the number of black males pursuing advanced degrees in STEM. © 2016 R. C. Thompson et al.

DOCUMENT TYPE: Article

SOURCE: Scopus

Smith, C., Wingate, L.

Strategies for Broadening Participation in Advanced Technological Education Programs: Practice and Perceptions

(2016) Community College Journal of Research and Practice, 40 (9), pp. 779-796.

https://www.scopus.com/inward/record.uri?eid=2-s2.0-84955095573&doi=10.1080%2f10668926.2015.1108252&partnerID=40&md5=a07de280f179d54ab316b9ca869d2062

DOI: 10.1080/10668926.2015.1108252

AFFILIATIONS: The Evaluation Center, Western Michigan University, Kalamazoo, MI, United States

ABSTRACT: Expanding and diversifying the STEM (science, technology, engineering, and mathematics) workforce is a national priority. The National Science Foundation is investing efforts at post secondary education institutions to engage individuals who have been historically underrepresented in STEM. This paper investigated the use of strategies to broaden participation in STEM by grantees of NSF’s Advanced Technological Education (ATE), who are primarily located at 2-year colleges. The ATE program focuses on developing and improving technician training programs to prepare students for employment in fields that rely on advanced technologiessuch as nanotechnology, photonics, and mechatronics. A survey, conducted annually by the authors of this study, was used to collect data from ATE grantees on their use and perceptions of strategies to broaden participation in STEM. The findings showed that strategies related to motivation and access to enhance recruitment are more widely used then strategies that improve retention. Respondents identified strategies related to providing financial assistance, mentoring, and conducting outreach activities as the most effective for reaching and engaging underrepresented minority students in academic programs. Despite these perceptions, these strategies seem to be underutilized among this group. © 2016 Taylor & Francis.

DOCUMENT TYPE: Article

SOURCE: Scopus