

# **2021 IEEE Frontiers in Education Conference (FIE 2021)**

**Lincoln, Nebraska, USA  
13 – 16 October 2021**

**Pages 1-613**



**IEEE Catalog Number: CFP21FIE-POD  
ISBN: 978-1-6654-3852-0**

**Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP21FIE-POD
ISBN (Print-On-Demand):	978-1-6654-3852-0
ISBN (Online):	978-1-6654-3851-3
ISSN:	1539-4565

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# TABLE OF CONTENTS

BLOCKLYPAR: FROM SEQUENTIAL TO PARALLEL WITH BLOCK-BASED VISUAL PROGRAMMING.....	1
<i>Ana Luisa Veroneze Solórzano, Andrea Schwertner Charão</i>	
MINING INFORMAL & SHORT STUDENT SELF-REFLECTIONS FOR DETECTING CHALLENGING TOPICS – A LEARNING OUTCOMES INSIGHT DASHBOARD .....	9
<i>Ong De Lin, Swapna Gottipati, Lo Siaw Ling, Venky Shankararaman</i>	
INTEGRATED DISCOURSE ANALYSIS & LEARNING SKILLS FRAMEWORK FOR CLASS CONVERSATIONS.....	18
<i>Devyn Wei Hung Tan, Swapna Gottipati, Kyong Jin Shim, Venky Shakararaman</i>	
TEACHING ENTREPRENEURSHIP FOR COMPUTER SCIENCE AND ENGINEERING STUDENTS USING ACTIVE LEARNING PEDAGOGICAL STRATEGIES.....	27
<i>Carlos N. Silla</i>	
EVALUATING FACTORS FOR EFFECTIVE FLIPPED CLASSROOM INSTRUCTION IN AN ADVANCED DATA MANAGEMENT COURSE .....	33
<i>Shamima Mithun, Morgan Vickery, Xiao Luo</i>	
SCOPING DESIGN PARAMETERS FOR EDUCATIONAL SOFTWARE DEVELOPMENT WITH THE ENTREPRENEURIAL MINDSET.....	42
<i>John K. Estell, Stephany Coffman-Wolph</i>	
RESEARCH EXPERIENCES FOR TEACHERS IN MACHINE LEARNING .....	51
<i>Kristen Jaskie, Jean Larson, Milton Johnson, Kathy Turner, Megan O'Donnell, Jennifer Blain Christen, Sunil Rao, Andreas Spanias</i>	
PERSONALIZING ONLINE COMPUTER ENGINEERING RESOURCES AND LABS FOR DIGITAL, EMBEDDED, AND COMPUTER SYSTEM COURSES.....	56
<i>Peter Jamieson, Ricardo Ferreira, José Augusto Nacif</i>	
ENGAGING UNDERGRADUATE STUDENTS IN A BIOMEDICAL RESEARCH PROJECT: A VIRTUAL COLLABORATION ACROSS INSTITUTES UNDER THE PANDEMIC ENVIRONMENT.....	61
<i>Yuezhou Wang, Daniel Ewert</i>	
A CRITICAL REFLECTION ON THE CHALLENGES OF IMPLEMENTING CULTURALLY SUSTAINING PEDAGOGY .....	66
<i>Diana A. Chen, Susan M. Lord, Joel Alejandro Mejia, Gordon D. Hoople</i>	
EVALUATING PARSONS PROBLEMS AS A DESIGN-BASED INTERVENTION .....	71
<i>Rita Garcia</i>	
FACE-TO-FACE VS. ONLINE LEARNING IN ENGINEERING COURSES.....	80
<i>Rosa María Guadalupe García-Castelán, Andres González-Nucamendi, Víctor Robledo-Rella, Luis Neri, Julieta Noguez</i>	
REINFORCING CYBERSECURITY HANDS-ON TRAINING WITH ADAPTIVE LEARNING .....	88
<i>Pavel Seda, Jan Vykopal, Valdemar Švábenský, Pavel Celeda</i>	

ENGINEERS' SITUATED USE OF DIGITAL RESOURCES TO AUGMENT THEIR WORKPLACE LEARNING ECOLOGY .....	97
<i>Hieu-Trung Le, Aditya Johri</i>	
KEEPING CURRICULUM RELEVANT: IDENTIFYING LONGITUDINAL SHIFTS IN COMPUTER SCIENCE TOPICS THROUGH ANALYSIS OF Q&A COMMUNITIES .....	105
<i>Habib Karbasian, Aditya Johri</i>	
INTRODUCING DESIRABLE DIFFICULTY IN STEM BARRIER COURSES WITH SPACED RETRIEVAL PRACTICE.....	112
<i>Campbell R. Bego, Keith B. Lyle, Jason C. Immekus, Patricia A. S. Ralston</i>	
USING SQL TO QUERY THE DIFFICULTY IMPOSED BY SPACED RETRIEVAL IN ENGINEERING MATHEMATICS.....	118
<i>Jeremy R. Boyd, Campbell R. Bego, Osvaldo Garcia, Patricia A. S. Ralston, Jason C. Immekus, Keith B. Lyle</i>	
A REVIEW OF DIGITAL ETHNOGRAPHIC METHODS WITH IMPLICATIONS FOR ENGINEERING EDUCATION RESEARCH.....	122
<i>Cory Brozina, Aditya Johri, Brent Jesiek, Russ Korte</i>	
INTEGRATING AN ENGINEERING JUSTICE APPROACH IN AN UNDERGRADUATE ENGINEERING MECHANICS COURSE.....	128
<i>Daniel I. Castaneda, Joi D. Merritt, Joel A. Mejia</i>	
SCIENCE AND TECHNOLOGY FIELDS AND HIGHER EDUCATION INSTITUTIONS WITH MATHEMATICALLY TRAINED CONTRIBUTORS: METADATA ANALYSIS OF IEEE PAPERS .....	133
<i>Takashi Ikegawa</i>	
ENCOURAGING ASIAN ACADEMIC STEM TEACHERS TO RESEARCH THEIR OWN TEACHING PRACTICE .....	142
<i>Anders Berglund, Mats Daniels, Jake Reardon</i>	
FIRST IN MY FAMILY: A COMPARISON OF SUBJECT-RELATED ROLE IDENTITIES BY PARENTAL LEVEL OF EDUCATION AND GENDER.....	146
<i>Dina Verdín, Allison Godwin</i>	
UNDERSTANDING HOW FAMILY INFLUENCES AND SUPPORT STUDENTS' CERTAINTY OF ENGINEERING MAJOR.....	155
<i>Heather Perkins, Brianna Benedict, Jacqueline Rohde, Allison Godwin, Maliq Washington, A. Lili Castillo</i>	
STUDENT EXPERIENCES AFTER THE MOVE TO FULLY ONLINE INSTRUCTION: A CASE STUDY OF ONE LARGE PUBLIC INSTITUTION .....	162
<i>Maria Chierichetti, Patricia Ryaby Backer</i>	
WOMEN THRIVING IN ENGINEERING: LISTENING TO AND LEARNING FROM WOMEN WHO FLOURISH IN UNDERGRADUATE ENGINEERING PROJECT TEAMS .....	171
<i>Rick Evans, Jia G. Liang, Mojdeh Asadollahipajouh, Stacey Kulesza</i>	
STUDENT ENGAGEMENT IN AN ONLINE SOFTWARE ENGINEERING COURSE.....	176
<i>Bruce R. Maxim, Thomas Limbaugh, Jeffrey J. Yackley</i>	
A SYSTEMATIC LITERATURE REVIEW ON TEACHING PROGRAMMING TO PEOPLE WITH COGNITIVE DISABILITIES.....	185
<i>Elaine Cristina Juvino De Araújo, Wilkerson L. Andrade</i>	

THE INVESTIGATION OF LOGISTIC REGRESSION METHODS APPLIED TO ENGINEERING EDUCATION USING PROJECT BASED LEARNING FOR AIRPORT SYSTEMS DESIGN .....	193
<i>Willie L. Brown, Ibibia Dabipi, Dinesh Sharma, Lei Zhang, Weiwei Zhu-Stone, Lanju Mei, Urban T. Wiggins, Tiara T. Cornelius, Sherley Jones, Roland Wescott, J. Anthony Sharp, Furman Glenn</i>	
MATTHEW EFFECTS IN LEARNING COMPUTER PROGRAMMING CONCEPTS .....	198
<i>Candido Cabo</i>	
ONLINE TEACHING AND LEARNING EXPERIENCE AT SOUTH AFRICAN HIGHER EDUCATIONAL INSTITUTION .....	207
<i>Senthil Krishnamurthy</i>	
SWOT ANALYSIS OF TWO DIFFERENT DESIGNS OF SUMMER PROFESSIONAL DEVELOPMENT INSTITUTES FOR K-8 CS TEACHERS.....	214
<i>Patrick Morrow, Leen-Kiat Soh, Gwen Nugent, Wendy Smith, Guy Trainin, Kent Steen</i>	
INTEGRATING PROGRAMMING AND ENGINEERING CONCEPTS USING RASPBERRY PI AND SCRATCH .....	223
<i>Madison Boudreaux, Sujing Wang, Stefan Andrei, Otilia Urbina, Dorothy A. Sisk</i>	
A CLASSIFICATION SCHEME FOR GAMIFICATION IN COMPUTER SCIENCE EDUCATION: DISCOVERY OF FOUNDATIONAL GAMIFICATION GENRES IN DATA STRUCTURES COURSES.....	231
<i>Adam Spanier, Sherri Weitl Harms, John Hastings</i>	
TOOLSET FOR COLLECTING SHELL COMMANDS AND ITS APPLICATION IN HANDS- ON CYBERSECURITY TRAINING .....	240
<i>Valdemar Švábenský, Jan Vykopal, Daniel Tovarnák, Pavel Celeda</i>	
PROBLEM-SOLVING SKILL DEVELOPMENT THROUGH STEM LEARNING APPROACHES .....	249
<i>Khaula Zeeshan, Chihiro Watanabe, Pekka Neittaanmäki</i>	
INTEGRATING MICROSOFT TEAMS TO PROMOTE ACTIVE LEARNING IN ONLINE LECTURE AND LAB COURSES.....	257
<i>Xiaoguang Ma, Asad Azemi, Dale Buechler</i>	
INVESTIGATING THE USAGE OF LIKERT-STYLE ITEMS WITHIN COMPUTER SCIENCE EDUCATION RESEARCH INSTRUMENTS .....	266
<i>Brian M. McSkimming, Sean Mackay, Adrienne Decker</i>	
CONFIDENCE IN PURSUING ENGINEERING: HOW FIRST-GENERATION COLLEGE STUDENTS' SUBJECT-RELATED ROLE IDENTITIES SUPPORTS THEIR MAJOR CHOICE .....	274
<i>Dina Verdín, Allison Godwin</i>	
TEACHING HPC CONCEPTS WITH SERIOUS GAMES.....	283
<i>Lauren Milechin, Julia Mullen</i>	
AGILE METHODS IN HIGHER EDUCATION: ADAPTING AND USING EDUSCRUM WITH REAL WORLD PROJECTS .....	288
<i>Michael Neumann, Lars Baumann</i>	
INTEGRATING MAKERSPACES INTO THE CURRICULUM - FACULTY DEVELOPMENT EFFORTS.....	296
<i>Maria-Isabel Carnasciali, Stephanie M. Gillespie, Ahmed Muntasir Hossain</i>	

DIVERSITY AND INCLUSION IN ENGINEERING AND COMPUTING: A SCOPING REVIEW OF RECENT FIE PAPERS .....	303
<i>Campbell R. Bego, Joshua C. Nwokeji</i>	
LEARN ACCESS CONTROL CONCEPTS IN A GAME.....	312
<i>Patrickson Weanquoi, Jinghua Zhang, Xiaohong Yuan, Jinsheng Xu, Elva J. Jones</i>	
THE EFFECTS OF PAIR-PROGRAMMING IN INTRODUCTORY PROGRAMMING COURSES WITH VISUAL AND TEXT-BASED LANGUAGES.....	318
<i>Patrick Korber, Renate Motschnig</i>	
FIRST-YEAR ENGINEERING STUDENTS' REFLECTIONS: PLANS AND ACTIONS FOR MEETING COURSE LEARNING OBJECTIVES.....	327
<i>Kayla Ney, Heidi A. Diefes-Dux</i>	
A SCIENTOMETRIC JOURNEY THROUGH THE FIE BOOKSHELF: 1982-2020 .....	335
<i>Mikko Apiola, Matti Tedre, Sonsoles López-Pernas, Mohammed Saqr, Mats Daniels, Arnold Pears</i>	
INTRODUCING UNDERGRADUATES TO RESTRICTED RESEARCH .....	344
<i>Alan J. Michaels</i>	
WHY DON'T YOU TELL ME WHAT I NEED TO KNOW? SELF-FLIPPED CLASSROOM AND STUDENTS' PERSONAL EPISTEMOLOGY .....	349
<i>Mats Daniels, Åsa Cajander, Roger McDermott, Anna Vasilcheko, Diane Golay</i>	
STEAM ACTIVITIES FOR CIVIL ENGINEERING CURRICULA. FROM CALCULUS TO DIGITAL TWINS .....	358
<i>Rolando Chacón, M. Rosa Estela</i>	
INTERACTIVE VIDEO ENHANCED TUTORIALS: A TOOL FOR PROMOTING SELF- PACED LEARNING AND ENGAGEMENT FOR FUTURE ENGINEERS .....	366
<i>Kathleen Koenig, Cijy Elizabeth Sunny, Alexandru Maries, Robert Teese</i>	
USE OF MACHINE LEARNING TO IDENTIFY PREDICTORS OF STUDENT PERFORMANCE IN WRITING VIABLE COMPUTER PROGRAMS WITH REPETITION LOOPS AND METHODS .....	371
<i>Candido Cabo</i>	
CURRICULUM AGILITY: RESPONSIVE ORGANIZATION, DYNAMIC CONTENT, AND FLEXIBLE EDUCATION.....	380
<i>Suzanne Brink, Carl Johan Carlsson, Mikael Enelund, Fredrik Georgsson, Elizabeth Keller, Reidar Lyng, Charles McCartan</i>	
EQUITY OF VOICE IN THE CLASSROOM.....	385
<i>Eileen Cashman, Josephine Archibald</i>	
COMPUTER AND MATERIALS SCIENCES CONVERGENCE FOR THE CREATION OF TECHNOLOGY BASED LEARNING RESOURCES AND NEW CURRICULUM DEVELOPMENTS .....	390
<i>Maria E. Romero-González, Marie-Luce Bourguet</i>	
PROFESSIONAL DEVELOPMENT FOR HIGH SCHOOL COMPUTER SCIENCE TEACHERS ON DATA SCIENCE THROUGH A FEMINIST LENS .....	394
<i>Anna Baynes, Aaminah Norris</i>	

EXPLORING STUDENTS' STEREOTYPES REGARDING COMPUTER SCIENCE AND STIMULATING REFLECTION ON ROLES OF WOMEN IN IT.....	399
<i>Oswald Comber, Renate Motschnig, Barbara Göbl, Hubert Mayer, Esra Ceylan</i>	
REVISITING THE DEFINITION OF OVERPERSISTENCE.....	408
<i>Baker A. Martin, Katherine M. Ehlert, Haleh B. Brotherton, Catherine E. Brawner, Marisa K. Orr</i>	
AN ENGINEERING COMPUTATIONAL THINKING DIAGNOSTIC: A PSYCHOMETRIC ANALYSIS .....	416
<i>Noemi V. Mendoza Diaz, Deborah A. Trytten, Russ Meier, So Yoon Yoon</i>	
CAN STUDENTS PRODUCE EFFECTIVE TRAINING DATA TO IMPROVE FORMATIVE FEEDBACK?.....	421
<i>Yulin Zhang, Edward F. Gehringer</i>	
LESSONS LEARNT CONDUCTING CAPTURE THE FLAG CYBERSECURITY COMPETITION DURING COVID-19.....	428
<i>Kee Hock Tan, Eng Lieh Ouh</i>	
AUTOMATION OF ASSESSMENT AND FEEDBACK IN IT TEACHING FROM THE TEACHING STAFF PERSPECTIVE.....	437
<i>Eerik Muuli, Marina Lepp, Reimo Palm, Piret Luik</i>	
A NEED TO INTRODUCE SYSTEMATIC TEAM-BASED EXPERIENCES IN SECONDARY SCHOOLS.....	446
<i>Preethi Baligar, Gopalkrishna Joshi, Ashok Shettar</i>	
EXPERIENCES WITH WEB-BASED SIGNAL ANALYSIS LABORATORIES AND ONLINE TRAINING DURING THE COVID-19 PERIOD .....	454
<i>Vivek Narayanaswamy, Photini Spanias, Sunil Rao, Andreas Spanias</i>	
USING ROLE-PLAYS TO IMPROVE ETHICAL UNDERSTANDING OF ALGORITHMS AMONG COMPUTING STUDENTS.....	458
<i>Ashish Hingle, Huzefa Rangwala, Aditya Johri, Alex Monea</i>	
STUDENT ASSESSMENT IN PBL-BASED TEACHING COMPUTING: PROPOSALS AND RESULTS.....	465
<i>Gustavo B. Lopes, Simone C. Dos Santos</i>	
CLOUDIFYING THE CURRICULUM WITH AWS .....	474
<i>Michael Soltys</i>	
ADOPTING AGILITY IN ACADEMIA THROUGH PILOT PROJECTS .....	481
<i>Omar Ochoa, Massood Towhidneiad, Timothy Wilson, James Pembridze, Erin Bowen, Carlos Castro</i>	
BIG DATA ANALYTICS APIS ARCHITECTURE FOR FORMATIVE ASSESSORS .....	486
<i>Wassim Mahfouz, Heinz-Dietrich Wuttke</i>	
PROMOTING CODE QUALITY VIA AUTOMATED FEEDBACK ON STUDENT SUBMISSIONS.....	495
<i>Oscar Karnalim, Simon</i>	
FACTORS MOTIVATING ENGINEERING FACULTY TO ADOPT AND TEACH NEW ENGINEERING TECHNOLOGIES.....	500
<i>Michelle Jarvie-Eggart, Alfred Owusu-Ansah, Shari L. Stockero</i>	

EVALUATION OF A LEARNER-CENTERED ACTIVATING LEARNING SITUATION WITH LARGE COHORTS IN THE UNIVERSITY .....	505
<i>Matthias Haack, Thomas N. Jambor</i>	
ENHANCED STUDENT ENGAGEMENT THROUGH TEAMWORK, GAMIFICATION, AND DIVERSITY & INCLUSION BEST PRACTICES IN AN ELECTROMAGNETICS COURSE.....	514
<i>Robert Kerestes, Renee Clark, Zekun Wu</i>	
LEARNER-CENTERED DISTANCE EDUCATION: EFFECTS OF ONLINE LEARNING ON THE SELF-DRIVEN LEARNING OFFICE APPROACH .....	520
<i>Alexandra Posekany, Dominik Dolezal, Gottfried Koppensteiner</i>	
ENGINEERING STUDENTS' STRATEGIES TO LEARN PROGRAMMING CORRELATE WITH MOTIVATION AND GENDER .....	529
<i>Maria Weurlander, Kristina Von Hausswolff</i>	
EVALUATING AUGMENTED REALITY FOR WIRELESS NETWORK SECURITY EDUCATION.....	538
<i>Martin Striegel, Jonas Erasmus, Parag Jain</i>	
PULSE OXIMETRY - TEACHING BASIC ELECTRONIC SENSOR SIGNAL PROCESSING IN A MEDICAL CONTEXT .....	547
<i>Lukas Mennicke, Klaus Hofmann</i>	
MOTOSHIELD: OPEN MINIATURIZED DC MOTOR HARDWARE PROTOTYPE FOR CONTROL EDUCATION.....	551
<i>Gergely Takács, Ján Boldocký, Erik Mikuláš, Tibor Konkoly, Martin Gulán</i>	
CONVERGENCE IN COLLABORATIVE COURSE DESIGN WHILE REMAINING VIRTUAL.....	560
<i>Shawna Thomas, Robert Lightfoot</i>	
EXPLORING THE ASSOCIATION BETWEEN SELF-REGULATION OF LEARNING AND PROGRAMMING LEARNING: A MULTINATIONAL INVESTIGATION.....	568
<i>Leonardo Silva, Antonio Mendes, Anabela Gomes, Gabriel Fortes, Chan Tong Lam, Calana Chan</i>	
INCORPORATION OF THE INTERNET OF THINGS WITHIN THE INTRODUCTORY COURSE ON MICROCONTROLLERS .....	576
<i>Steve Rowland, Ramakrishnan Sundaram</i>	
THE DEVELOPMENT AND VALIDATION OF A FRAMEWORK FOR TEACHING SOFTWARE ENGINEERING THROUGH STARTUP PRACTICE IN HIGHER EDUCATION .....	580
<i>Orges Cico, Anh Nguyen Duc, Letizia Jaccheri</i>	
PROFESSIONAL DEVELOPMENT IN COMPUTATIONAL THINKING FOR TEACHERS IN COLOMBIA.....	589
<i>Alejandro Espinal, Camilo Vieira, Alejandra J. Magana</i>	
ADAPTING AN OER TEXTBOOK FOR THE INVERTED CLASSROOM MODEL — HOW TO FLIP THE CLASSROOM WITH BBC MICRO:BIT EXAMPLE TASKS .....	593
<i>Oliver Kastner-Hauler, Karin Tengler, Heike Demarle-Meusel, Barbara Sabitzer</i>	
CREATE!: METACOGNITION IN AN INTERDISCIPLINARY COURSE .....	601
<i>Yasir Gamiieldien, Benjamin Chambers, Jennifer M. Case, Nicole Pitterson</i>	



IS THIS THE REAL LIFE? EXPLORING HOW VIRTUAL LEARNING ENVIRONMENTS INFLUENCE ENGINEERING IDENTITY .....	606
<i>Kelsey Scalaro, Indira Chatterjee, Ann-Marie Vollstedt, Jeffrey Lacombe, Adam Kim</i>	
HOW DO BEBRAS TASKS EXPLORE ALGORITHMIC THINKING SKILL IN A COMPUTATIONAL THINKING CONTEST?.....	614
<i>Ana Liz Souto Oliveira, Wilkerson L. Andrade, Dalton D. Serey Guerrero, Monilly Ramos Araujo Melo</i>	
EXPLORING FACTORS THAT INFLUENCE UNDERREPRESENTED STUDENTS TO PERSIST IN COMPUTER SCIENCE .....	621
<i>Noura Albarakati, Lisa Dipippo</i>	
ADDRESSING CHALLENGES OF COMMUNITY AND ACADEMICS FOR CS PRE- MAJORS: CS REDSHIRT PROGRAM .....	628
<i>Gerald C. Gannod, April R. Crockett, Julianne M. Cox, Shataydrian Y. Marshall, Laura Nisbet, Angela D. Clark, Lucy McGauvran</i>	
STUDENT SUCCESS ANALYSIS FROM RUNNING A PRE-COLLEGE COMPUTER SCIENCE AND MATH SUMMER PROGRAM .....	635
<i>Jaime Raigoza</i>	
SE-FIRST: A NEW APPROACH TO SOFTWARE ENGINEERING EDUCATION .....	639
<i>Colin Maly, Suzette Person, Leen-Kiat Soh</i>	
THE EFFECT OF GOAL ORIENTATIONS AND BELIEF MOTIVATION ON UNDERGRADUATE ENGINEERING STUDENTS' ACHIEVEMENT.....	648
<i>Olanrewaju P. Olaogun, Adurangba V. Oje, Nathaniel J. Hunsu, Peter H. Carnell</i>	
CSIT XXX – APPLIED PROGRAMMING FOR ALL MAJORS: A CONTEXTUALIZED COURSE BASED ON INTER-DISCIPLINARY CURRICULUM DEVELOPMENT .....	655
<i>Pamela Bogdan, Sylvia Riviello</i>	
“WE MAKE THE VILLAGE” - INSPIRING STEM AMONG YOUNG GIRLS AND THE POWER OF CREATIVE ENGINEERING EDUCATION IN ACTION .....	659
<i>Kayli Battel, Natalie Foster, Lilianny Virguez Barroso, Sreyoshi Bhaduri, Kritin Mandala, Lissa Erickson</i>	
SOURCE CODE PLAGIARISM DETECTION IN AN EDUCATIONAL CONTEXT: A LITERATURE MAPPING .....	666
<i>Rodrigo C Aniceto, Maristela Holanda, Carla Castanho, Dilma Da Silva</i>	
YOUR PHONE AS A SENSOR: MAKING IOT ACCESSIBLE FOR NOVICE PROGRAMMERS .....	675
<i>Devin Jean, Brian Broll, Gordon Stein, Ákos Lédeczi</i>	
INVEST: EQUIPPING ENGINEERING STUDENTS WITH PROFESSIONAL COMPETENCIES AND INTERPERSONAL SKILLS.....	680
<i>Anuli Ndubuisi, Elham Marzi</i>	
JUMP IN THE SHARK TANK TO IMPROVE YOUR TEACHING.....	685
<i>Sarah Zappe, Stephanie Cutler</i>	
INCLUDING COMPUTER SYSTEMS ASSIGNMENTS IN INTRODUCTORY PROGRAMMING COURSES.....	687
<i>Christine F. Reilly, Arathi Prasad</i>	

DESIGN AND SUPERVISION MODEL OF GROUP PROJECTS FOR ACTIVE LEARNING.....	692
<i>Yi Meng Lau, Kyong Jin Shim, Swapna Gottipati</i>	
TEACHING AND LEARNING STRATEGIES FOR SOFTWARE PROCESS SUBJECT.....	701
<i>José Augusto De Sena Quaresma, Sandro Ronaldo Bezerra Oliveira</i>	
A STANDARD FRAMEWORK FOR GAMIFICATION EVALUATION IN EDUCATION AND TRAINING OF SOFTWARE ENGINEERING: AN EVALUATION FROM A PROOF OF CONCEPT.....	708
<i>Rodrigo Henrique Barbosa Monteiro, Sandro Ronaldo Bezerra Oliveira, Maurício Ronny De Almeida Souza</i>	
DEVELOPING AND IMPLEMENTING AN AEROSPACE MACROETHICS LESSON IN A REQUIRED SOPHOMORE COURSE.....	715
<i>Andrew Benham, Maria Callas, Raymie Fotherby, Megan Jones, Jasmin Chadha, Mikaela Dobbins, Aaron W. Johnson</i>	
A DIAGNOSIS ON SOFTWARE TESTING EDUCATION IN THE BRAZILIAN UNIVERSITIES.....	724
<i>Isaac Souza Elgrably, Sandro Ronaldo Bezerra De Oliveira</i>	
“DESIGN-BASED” INSTRUCTION – TEACHING ENGINEERING DESIGN IN THE CONTEXT OF PRACTICE.....	732
<i>Shirley Fleischmann, Sanjivan Manoharan</i>	
METHODOLOGY MATTERS: EMPLOYING PHENOMENOGRAPHY TO INVESTIGATE EXPERIENCES IN COMPUTING FIELDS AND THE APPLICATION OF THEORETICAL FRAMEWORKS.....	739
<i>Stephanie Lunn, Monique Ross</i>	
A VIRTUAL COMMUNITY OF PRACTICE FOR ENHANCED TEACHING AND CONVERGENCE TO STRENGTHEN STUDENT LEARNING, ENGAGEMENT, AND INCLUSION.....	748
<i>Tracy Hammond, Randy Brooks, Shawna Thomas, Charles W. Peak, Pauline Wade, Charles Patrick, Samantha Ray, Paul Taele</i>	
CONVERTING A BIOMEDICAL INSTRUMENTATION LAB FROM IN-PERSON TO ONLINE.....	756
<i>Rebecca M. Reck</i>	
A STUDY ON ASSETS APPLIED IN EXPLORATORY TEST DESIGN AND EXECUTION: AN INTERVIEW APPLICATION.....	760
<i>Igor Ernesto Ferreira Costa, Sandro Ronaldo Bezerra Oliveira</i>	
EDUCATORS' PERCEPTIONS OF THE INFLUENCE OF ACADEMIC ENVIRONMENT ON ETHICS EDUCATION: A COMPARATIVE CASE STUDY OF TWO ENGINEERING DEPARTMENTS.....	768
<i>Madeline Polmear, Angela R. Bielefeldt, Daniel Knight</i>	
A MAPPING OF PRESCRIBED ASSETS IN THE ACM / IEEE AND SBC CURRICULUM TO THE TEST DESIGN AND EXECUTION PRACTICES OF TMMI.....	777
<i>Igor Ernesto Ferreira Costa, Sandro Ronaldo Bezerra Oliveira</i>	
ON TRACK: SEEING ENGINEERING AS SOCIOTECHNICAL USING FITNESS TRACKERS.....	785
<i>Susan M. Lord, Laura A. Gelles</i>	

PAIR-CODING AS A METHOD TO SUPPORT INTERCODER AGREEMENT IN QUALITATIVE RESEARCH .....	794
<i>Jeffrey W. Paul, Renato Bezerra Rodrigues, Jillian Seniuk Cicek</i>	
PEER INSTRUCTION IN ONLINE SYNCHRONOUS SOFTWARE ENGINEERING - FINDINGS FROM FINE-GRAINED CLICKER DATA .....	799
<i>Bhuvana Gopal, Stephen Cooper</i>	
CHANGING LEARNING OPPORTUNITIES AND OUTCOMES WITH VARYING LEVELS OF REMOTE AND IN-PERSON ENGINEERING EDUCATION OUTREACH .....	807
<i>Kristen Okorn, Trang Tran, Joseph Polman, Daniel Knight, Michael Hannigan</i>	
A TRANS-REGIONAL ONLINE AND OFFLINE FUSION LAB TEACHING PRACTICE THROUGH CROSS-UNIVERSITY COOPERATION.....	815
<i>Yanpin Ren, Changshui Zhang</i>	
MATLABARDUINO.ORG: AN OPEN-SOURCE WEBSITE AND YOUTUBE CHANNEL FOR EMBEDDED SYSTEMS EDUCATION.....	820
<i>Pramod Abichandani, Deepan Lobo, Chris Berry, Vaishali Parikh, William Fligor, William McIntyre</i>	
WHAT MOTIVATES ENGINEERING STUDENTS IN IT IN BHUTAN TO LEARN PROGRAMMING.....	828
<i>Eusang Lhaki Dorji, Jonathan Franzén, Palden Ongmo Lhendup, Anders Berglund</i>	
FAQ AS A TOOL IN ASYNCHRONOUS MODE OF DELIVERY IN BLENDED LEARNING.....	832
<i>Radhika Amashi, M Vijayalakshmi, B B Kotturshettar, Krishnaraia Kodancha, Ashok Shettar</i>	
DEVELOPING A SURVEY FOR ENGINEERING FACULTY KNOWLEDGE AND INTEREST IN DIVERSITY, EQUITY, INCLUSION TOPICS.....	837
<i>Stephen Secules, Sung Eun Park, Cassandra McCall, Maimuan Begum Kali</i>	
A ROBOTICS-BASED LEARNING ENVIRONMENT SUPPORTING COMPUTATIONAL THINKING SKILLS — DESIGN AND DEVELOPMENT.....	842
<i>Karin Tengler, Oliver Kastner-Hauler, Barbara Sabitzer</i>	
EDUCATIONAL INITIATIVES TO INCREASE DIVERSITY IN CS1 COURSES: A LITERATURE MAPPING OF U.S. EFFORTS .....	848
<i>Maristela Holanda, Keishla D. Ortiz-Lopez, Dilma Da Silva, Richard Furuta</i>	
EMPLOYEE DEVELOPMENT PROGRAM: A GENERATION MODEL FOR PROJECT-BASED LEARNING IMPLEMENTATION AT THE UNIVERSITY .....	856
<i>Vasilii Borisov, Olga Podoliak, Anastasia Markina, Valentina Ovchinnikova</i>	
STUDYING ABROAD: EXPERIENCES OF BHUTANESE IT ENGINEERING STUDENT.....	862
<i>Kuenzang Choden, Jiecong Yang, Sangay Wangdi, Anders Berglund</i>	
FRAMING SELF-ORGANIZED ONLINE TEAM COLLABORATION IN A HIGHER EDUCATION COURSE ON INFORMATICS AND SOCIETY .....	867
<i>Thomas Spielhofer, David Haselberger</i>	
THE EFFECT OF ELECTRONIXTUTOR ON UNDERGRADUATE STUDENTS' ACQUISITION OF CONCEPTUAL LEARNING, PROBLEM SOLVING, AND MODEL BUILDING OF ELECTRONIC CIRCUITS.....	876
<i>Shi Feng, Alejandra J. Magana</i>	

A SYSTEMATIC REVIEW OF LITERATURE ON THE EFFECTIVENESS OF INTELLIGENT TUTORING SYSTEMS IN STEM.....	885
<i>Shi Feng, Alejandra J. Magana, Dominic Kao</i>	
ABET CYBERSECURITY CONTINUAL COURSE IMPROVEMENTS FOR SECURE SOFTWARE DEVELOPMENT .....	894
<i>Suzanna E. Schmeelk, Denise M. Dragos, Joan E. DeBello</i>	
ADDING INTERACTIVITY TO EDUCATION OF COMPLEX WIRELESS NETWORKS USING DIGITAL GAME-BASED LEARNING .....	900
<i>Seungmo Kim</i>	
PREDICTING AT-RISK STUDENTS TO FACILITATE SCAFFOLDING INSTRUCTIONS .....	905
<i>Qiong Cheng, Mahitha Garikipati, Smirthi Meenakshisundaram</i>	
USE OF ACTIVE METHODOLOGIES FOR THE DEVELOPMENT OF A TEACHING PLAN FOR THE ALGORITHMS SUBJECT.....	912
<i>Fabricio Wickey Da Silva Garcia, Elielton Da Costa Carvalho, Sandro Ronaldo Bezerra Oliveira</i>	
REMOTE TEACHING AND LEARNING OF SOFTWARE TESTING USING ACTIVE METHODOLOGIES IN THE COVID-19 PANDEMIC CONTEXT .....	921
<i>Isaac Souza Elgrably, Sandro Ronaldo Bezerra Oliveira</i>	
DESIGN, IMPLEMENTATION, AND ASSESSMENT OF SYNCHRONIZED WORLDWIDE ONLINE ROBOTICS COMPETITIONS FOR ENGINEERING AND COMPUTING EDUCATION.....	930
<i>Chan-Jin Chung, Shannan Palonis, Elmer Santos, Pamela Sparks, Christopher Cartwright</i>	
STUDENT AND EXPERT CONCEPTIONS OF THE WORD “EFFICIENCY” .....	938
<i>Eric Burkholder</i>	
SYSTEMS ENGINEERING EDUCATION ECOSYSTEM PORTAL .....	944
<i>Jon Wade, Arianne X. Collopy, Cihan Dagli, Hortense Gerardo, Keeley Elliott, Stephanie Chesler, Jacob T. Wright, Kristin L. Wood</i>	
PEER-MENTORING IN DESIGN PROJECTS IN PROJECT-BASED LEARNING (PBL) AT FIRST-YEAR ENGINEERING COURSE .....	948
<i>Jyoti Gadad, Vinay Talageri, Preethi Baligar, Gopalkrishna Joshi</i>	
RESEARCH OF AN ONLINE-OFFLINE BLENDING TEACHING MODEL FOR THE POST COVID-19 ERA—USING A C PROGRAMMING LANGUAGE COURSE AS AN EXAMPLE .....	953
<i>Ying Li, You Song, Simbarashe Matutu, Duan Li</i>	
DEVELOPMENT AND IMPLEMENTATION OF AN ONLINE ADAPTIVE GAMIFICATION PLATFORM FOR LEARNING COMPUTATIONAL THINKING .....	958
<i>Andrew Keong Ng, Indriyati Atmosukarto, Wean Sin Cheow, Karin Avnit, Mun Hin Yong</i>	
TRAINING A NEW GENERATION OF SOLAR DEVELOPERS WITH THE LATEST TOOLS AND PRACTICES PROVIDED BY DOE'S PROFESSIONALS: THE UPRM EXPERIENCE.....	964
<i>Cristian R. Meléndez-González, Alanis M. Colón-González, Angel G. Ortiz-Rodriguez, Maria A. López-Silva, Eduardo Ortiz-Rivera</i>	
A SYSTEMATIC LITERATURE REVIEW ON KNOWLEDGE TRACING IN LEARNING PROGRAMMING.....	972
<i>Philip I. S. Lei, António José Mendes</i>	

INVESTIGATING LEARNERS' BEHAVIORS AND IMPLEMENTING INTERVENTION IN A SPOC.....	979
<i>Han Wan, Zihao Zhong, Lina Tang, Xiaopeng Gao</i>	
BUILDING A MOTIVATING AND AUTONOMY ENVIRONMENT TO SUPPORT ADAPTIVE LEARNING.....	984
<i>Qiong Cheng, David Benton, Andrew Quinn</i>	
EXPLORATION AND PRACTICE OF AN INNOVATIVE IDEA AND METHOD OF ORGANIZED ENGINEERING EDUCATION.....	991
<i>Tao Zhang, Haiyan Huang, Feng Chen</i>	
INTEGRATION OF INFORMATION TECHNOLOGY CERTIFICATIONS INTO UNDERGRADUATE COMPUTING CURRICULUM .....	999
<i>Eng Lieh Ouh, Kyong Jin Shim</i>	
INVESTIGATING CHALLENGES OF STUDENT CENTERED LEARNING IN THAI HIGHER EDUCATION DURING THE COVID-19 PANDEMIC .....	1008
<i>Pornrat Wattanakasiwich, Nuttee Suree, Suthida Chamrat, Washirasorn Saengsuwan, Wandee Suttharangsee, Tanate Panrat, Jareerat Ruamcharoen, Wannapon Trianpo, Somkid Amornsamankul, Wasakorn Laesanklang, Anders Berglund, Panuwan Chantawannakul</i>	
THE EFFECT OF THE COVID-19 EPIDEMIC ON THE SELF-PERCEPTION OF TRAINING NEEDS IN STEAM LECTURERS.....	1015
<i>Ariadna Llorens Garcia, Joana Prat, Marc Alier, Jesus Alcober, David Lopez</i>	
DESIGNING TRAINING ACTIVITIES FOR A NEW PHD PROGRAM IN ENGINEERING EDUCATION.....	1020
<i>David Lopez</i>	
CONTEXT, COMPETENCY AND AUTHENTICITY IN STEM EDUCATION.....	1025
<i>Roger McDermott, Mats Daniels</i>	
INTEGRATING COOPERATIVE LEARNING PRINCIPLES INTO THE ENGINEERING DESIGN PROCESS: A MIXED-METHODS STUDY AT FIRST-YEAR UNDERGRADUATE ENGINEERING .....	1034
<i>Preethi Baligar, Rohit Kandakatla, Gopalkrishna Joshi, Ashok Shettar</i>	
CHALLENGES OF DATABASE SYSTEMS TEACHING AMIDST THE COVID-19 PANDEMIC .....	1039
<i>Edna Dias Canedo, Ian Nery Bandeira, Pedro Henrique Teixeira Costa</i>	
TEACHING PRACTICE REFORMS TOWARDS SOFTWARE-HARDWARE COLLABORATION IN COMPUTER SYSTEM ABILITY TRAINING-TAKING FPGA DESIGN COURSE AS AN EXAMPLE.....	1048
<i>Ying Li, Jianwei Niu, Simbarashe Matutu, Qianben Qi</i>	
NOVICE PROGRAMMING STUDENTS' REFLECTIONS ON STUDY MOTIVATION DURING COVID-19 PANDEMIC.....	1053
<i>Meija Lohiniva, Ville Isomöttönen</i>	
DESIGNING PEDAGOGICAL AGENTS TOWARD THE RECOMMENDATION AND INTERVENTION BASED ON STUDENTS' ACTIONS IN AN ITS.....	1062
<i>Arcanjo Miguel Mota Lopes, José Francisco De Magalhães Netto</i>	

SOFTWARE QUALITY AS A SUBSIDY FOR TEACHING PROGRAMMING.....	1070
<i>Pedro Henrique Gomes, Rogério Eduardo Garcia, Danilo Medeiros Eler, Ronaldo Celso Correia, Celso Olivete Junior</i>	
A HYBRID APPROACH TO ADMINISTERING A SPATIAL SKILLS INTERVENTION .....	1079
<i>Ryan Bockmon, Stephen Cooper, Jian Zhang, Mohsen Dorodchi, Sheryl Sorby</i>	
IS REMOTE LEARNING BECOMING THE NEW NORM? A SURVEY-BASED STUDY ON THE CAUSES BEHIND THE POOR IN-PERSON CLASSROOM ATTENDANCES DURING THE PANDEMIC .....	1088
<i>Mohamed A. S. Zaghoul, Amr M. Hassan, Ahmed Dallal</i>	
STUDENTS' PERSPECTIVES ON ONLINE LECTURE DELIVERY METHODS FOR PROGRAMMING COURSES: A SURVEY-BASED STUDY DURING COVID-19 .....	1092
<i>Amr M. Hassan, Ahmed Dallal, Mohamed A. S. Zaghoul</i>	
IS MIDFIELD FOR ME? EXPLORING THE MULTIPLE INSTITUTION DATABASE FOR INVESTIGATING ENGINEERING LONGITUDINAL DEVELOPMENT .....	1097
<i>Susan M. Lord, Marisa K. Orr, M. W. Ohland, R. A. Long, Richard A. Layton</i>	
A STUDY OF STUDENTS PERSPECTIVES ON DIFFERENT PEDAGOGICAL PRACTICES FOR REMOTE DIGITAL SIGNAL PROCESSING COURSES .....	1101
<i>Ahmed Dallal, Mohamed Zaghoul, Amr Hassan</i>	
A SURVEY-BASED STUDY OF STUDENTS' PERSPECTIVES ON REMOTE ELECTRONICS AND ELECTRONICS LAB COURSES DURING COVID-19 PANDEMIC.....	1106
<i>Mohamed A. S. Zaghoul, Amr M. Hassan, Ahmed Dallal</i>	
SENSE OF BELONGING OF FEMALE UNDERGRADUATE STUDENTS IN INTRODUCTORY COMPUTER SCIENCE COURSES AT UNIVERSITY OF BRASÍLIA IN BRAZIL .....	1110
<i>Maristela Holanda, Aleteia Araujo, Dilma Da Silva, George Von Borries, Roberta B. Oliveira, Carla Cavalcante Koike, Carla D. Castanho</i>	
FIRST-YEAR ENGINEERING STUDENT REFLECTIONS ON SERVICE LEARNING: THE EWB AUSTRALIA CHALLENGE.....	1116
<i>Amanda Singer, Michelle Jarvie-Eggart, Judith Perlinger</i>	
CONVERGING DIGITAL LITERACY THROUGH VIRTUAL REALITY .....	1121
<i>Mark Frydenberg, Diana Andone</i>	
A GAMIFICATION TO SUPPORT TEACHING-LEARNING OF KNOWLEDGE MANAGEMENT IN INFORMATION TECHNOLOGY: A PLAN BASED ON FEATURES OF PEDAGOGICAL APPROACHES.....	1128
<i>Antonilson Da Silva Alcantara, Sandro Ronaldo Bezerra Oliveira</i>	
PREDICTING STUDENT PERFORMANCE BASED ON LOGS IN MOODLE LMS .....	1137
<i>Mariela Mizota Tamada, Rafael Giusti, José Francisco De Magalhães Netto</i>	
PAIR- VERSUS SOLO-PROGRAMMING OF MINI-GAMES AS A SETTING FOR LEARNING TO PROGRAM: AN ACTION RESEARCH APPROACH .....	1145
<i>Arash Issaee, Renate Motschnig, Oswald Comber</i>	
THE RELATIVE IMPORTANCE OF TEAM DYNAMICS IN PREDICTING EFFECTIVE TEAMWORK BEHAVIORS.....	1154
<i>Siqing Wei, Matthew W. Ohland</i>	

SEEING THE VOICE OF THE STUDENT: A PILOT STUDY OF CUSTOMER-DRIVEN COURSES.....	1159
<i>Orges Cico, Letizia Jaccheri, Anh Nguyen Duc</i>	
ANALYZING COMPETENCES IN SOFTWARE TESTING: COMBINING THEMATIC ANALYSIS WITH NATURAL LANGUAGE PROCESSING (NLP) .....	1167
<i>Tajmilur Rahman, Joshua Nwokeji, Richard Matovu, Stephen Frezza, Harika Sugnanam, Aparna Pisolkar</i>	
CONVERTING AN UNDERGRAD-LAB TO AN INTERACTIVE E-LEARNING EXPERIENCE THAT ENABLES STUDENT TEAMWORK.....	1176
<i>Ferdinand Keil, David Riehl, Klaus Hofmann</i>	
A HANDS-ON APPROACH TO CLOUDIFYING CURRICULUM IN COMPUTING AND ENGINEERING EDUCATION.....	1181
<i>Joshua C. Nwokeji, Myra Roldan, Micheal Soltys, Terry Holmes</i>	
ENHANCING THE INTELLIGENCE OF THE ADAPTIVE LEARNING SOFTWARE THROUGH AN AI ASSISTED DATA ANALYTICS ON STUDENTS LEARNING ATTRIBUTES WITH UNEQUAL WEIGHT .....	1184
<i>Yanzhen Qu, Olanrewaju Ogunkunle</i>	
TOWARDS A CULTURALLY RESPONSIVE DESIGN EXPERIENCE: HOW STUDENTS' COMMUNITY CAPITAL CONTRIBUTE TO THEIR DESIGN APPROACH .....	1190
<i>Anilegna Nuñez Abreu, Luis Guardia, Valerie Vanessa Bracho Perez, Indhira Maria Hasbun, Alexandra Coso Strong</i>	
SLIDESPAC: A SOCIAL REALTIME TEACHING AND LEARNING ENVIRONMENT.....	1195
<i>Richard Gessner, Jace Hargis, Jon Wade</i>	
ORAL EXAMS FOR LARGE-ENROLLMENT ENGINEERING COURSES TO PROMOTE ACADEMIC INTEGRITY AND STUDENT ENGAGEMENT DURING REMOTE INSTRUCTION .....	1199
<i>Marko Lubarda, Nathan Delson, Curt Schurgers, Maziar Ghazinejad, Saharnaz Baghdadchi, Alex Phan, Mia Minnes, Josephine Relaford-Doyle, Leah Klement, Carolyn Sandoval, Huihui Qi</i>	
INTEGRATING MACHINE LEARNING CONCEPTS INTO UNDERGRADUATE CLASSES.....	1204
<i>Chinmay Sahu, Blaine Ayotte, Mahesh K. Banavar</i>	
ANALYSIS OF LEARNING BEHAVIOR IN A PROGRAMMING COURSE USING PROCESS MINING AND SEQUENTIAL PATTERN MINING .....	1209
<i>Eduardo Machado Real, Edson Pinheiro Pimentel, Juliana Cristina Braga</i>	
TOWARDS A COMMUNITY VISION OF INTEGRATED ENGINEERING.....	1218
<i>Rebecca Bates, Susan M. Lord, Emanuela Tilley</i>	
SKETCHNOTING, A VISUAL WAY TO IMPROVE CREATIVE CONFIDENCE AND CRITICAL THINKING IN THE VIRTUAL ENVIRONMENT.....	1221
<i>Verena Paepcke-Hjeltness, Mani Mina</i>	
STIRRING UP A SPECIAL SAUCE, A SECOND COURSE: MARRYING ELECTRICAL AND COMPUTER ENGINEERING WITH THRESHOLD CONCEPTS FOR ECE 101 .....	1224
<i>David Reeping, Desen Ozkan, Lisa McNair, Tom Martin</i>	

VIOT LAB: A VIRTUAL REMOTE LABORATORY FOR INTERNET OF THINGS BASED ON THINGSBOARD PLATFORM .....	1228
<i>Mario Casillo, Francesco Colace, Massimo De Santo, Angelo Lorusso, Rosalba Mosca, Domenico Santaniello</i>	
MORAL NARRATIVES OF PRACTICING ENGINEERS ACROSS INDUSTRY SECTORS FOR ENGINEERING ETHICS EDUCATION .....	1233
<i>Dayoung Kim, Brent K. Jesiek, Michael C. Loui</i>	
THEMATIC ANALYSIS OF REFLECTIVE PEER FEEDBACK IN PROGRAMMING-HEAVY ENGINEERING COURSES .....	1237
<i>Abhimanyu Ghosh, Abhishek Verma</i>	
IS2020:COMPETENCY-BASED INFORMATION SYSTEMS CURRICULUM GUIDELINES .....	1246
<i>Venky Shankararaman, Paul M. Leidig, Greg Anderson, Mark Thouin</i>	
BUILDING DESIGN EXPERIENCE AND A GREATER SENSE OF COMMUNITY THROUGH AN INTEGRATED DESIGN PROJECT.....	1250
<i>Joshua Hamel, Claire Strebinger, Eric Gilbertson, Yen-Lin Han, Kathleen Cook, Teodora Shuman, Greg Mason</i>	
EXAMINING THE INFLUENCE OF A PROFESSIONAL DEVELOPMENT PROGRAM ON HIGH SCHOOL COUNSELORS' PRACTICES REGARDING ENGINEERING.....	1255
<i>Jacob Roarty, Medha Dalal, Lydia Ross, Adam Carberry</i>	
MAKE EXPERIMENTAL DEVICE TO BE A TOY - THE EXPERIMENTAL TEACHING IN DIGITAL LOGIC CIRCUIT COURSE .....	1260
<i>Shanshan Li, Ninghan Zheng, Yuchao Gao, Chengbin Quan, Weidong Liu</i>	
A COVID-19 TEACHING EXPERIMENT: COMBINING COMPETENCY-BASED ASSESSMENT AND MICRO-COURSES TO TEACH TECHNICAL AND NON-TECHNICAL SKILLS .....	1265
<i>Sébastien Combéfis</i>	
TRANSFORMING A COURSE WITH A TRADITIONAL EVALUATION INTO A COMPETENCY-BASED ASSESSMENT APPROACH: A PRACTICAL EXPERIMENT .....	1270
<i>Sébastien Combéfis, Virginie Van Den Schrieck</i>	
FACILITATING INTERPERSONAL EXCHANGE ON DIGITAL TRANSFORMATIONS BY ANCHORING A MOOC IN A DISTANCE-LEARNING UNIVERSITY COURSE.....	1275
<i>David Haselberger, Matthias Steinböck, Fares Kayali</i>	
A LITERATURE OVERVIEW OF DIFFERENCES BETWEEN ENGINEERING EDUCATION AND OTHER DISCIPLINARY EDUCATION .....	1284
<i>Maartje Van Den Bogaard, Ibrahim H. Yeter, Johannes Strobel</i>	
THE IMPORTANCE OF USING THE CODEINSIGHTS MONITORING TOOL TO SUPPORT TEACHING PROGRAMMING IN THE CONTEXT OF A PANDEMIC .....	1288
<i>Nuno Gil Fonseca, Luís Macedo, António José Mendes</i>	
USING FUTURES STUDIES IN COMPUTING AND ENGINEERING EDUCATION: “EMERGENTIST EDUCATION” IN AN OPEN-ENDED GROUP PROJECT .....	1296
<i>Anne-Kathrin Peters, Diane Golay, Mats Daniels</i>	



TRANSITION FROM IN-PERSON LEARNING TO TECHNOLOGY ENHANCED LEARNING IN ENGINEERING EDUCATION: FACULTY CHALLENGES .....	1305
<i>M Vijaylakshmi, Preethi Baligar, Kaushik Mallibhat, Sanjeev M. Kavale, Gopalkrishna Joshi, Ashok Shettar</i>	
ELECTION SECURITY IN THE CLOUD: A CTF ACTIVITY TO TEACH CLOUD AND WEB SECURITY .....	1310
<i>Zachary Romano, Jennifer Windsor, Mathew Vanderpol, Joel Coffman</i>	
TOWARDS THE IMPLEMENTATION OF CIRCULAR ECONOMY IN ENGINEERING EDUCATION: A SYSTEMATIC REVIEW .....	1315
<i>Jaime A. Mesa, Iván Esparragoza</i>	
DEVELOPMENT OF AN EXTENDED CONSTRUCTIVE ALIGNMENT MODEL FOR REDESIGNING COURSES TO FIT DISRUPTED CONTEXTS.....	1323
<i>Imane Aboutajedyne, Ahmed Aboutajeddine, Yassine Salih Alj</i>	
MUTUAL IMPROVEMENT BETWEEN TEACHING MATERIALS AND ASSESSMENT TOOLS FOR K-12 PROGRAMMING EDUCATION.....	1328
<i>Hideo Nagumo, Yasumasa Oomori, Yasuhiro Takemura</i>	
STATIC ANALYSIS MODEL FOR ASSESSING SOURCE CODES WITH TFIDF .....	1336
<i>Ricardo Lemos De Souza, Fabiana Zaffalon Ferreira, Silvia Da Silva Botelho</i>	
LESSONS LEARNED FROM FITECH TURKU, A 18 MILLION EUROS UNIVERSITY COLLABORATION PROJECT TO COMPLEMENT THE REGIONAL DEMAND FOR MASTER DEGREE ENGINEERS .....	1345
<i>Timo Vasankari, Liina Vahala, Carolina Islas Sedano</i>	
HOW DO STUDENTS FEEL ABOUT AUTOMATED SECURITY STATIC ANALYSIS EXERCISES?.....	1352
<i>Akond Rahman, Hossain Shahriar, Dibyendu Brinto Bose</i>	
DESIGN ACTIVITY WORKSHEET: IDENTIFYING DATA SOURCES FOR DEVELOPING A RESEARCH PLAN.....	1356
<i>Vetria L. Byrd</i>	
CRAFTING COMPETITIVE PROPOSALS FOR NSF PROGRAMS RELATED TO ENGINEERING AND COMPUTING EDUCATION.....	1363
<i>John Jackman, J. Kemi Ladeji-Osias, Abi Ilumoka, Margret Hjalmarson, Jill Nelson, Vinod Lohani, Eric Sheppard, Christine Grant</i>	
WHAT ARE BIOMEDICAL ENGINEERING EMPLOYERS LOOKING FOR IN NEW HIRES? A QUALITATIVE SYNTHESIS .....	1368
<i>Cassandra Sue Ellen Jamison, Vibhavari Vempala, Annie Wang, Jan P. Stegemann, Aileen Huang-Saad</i>	
EDUCATIONAL ROBOTICS APPLIED TO COMPUTATIONAL THINKING DEVELOPMENT: A SYSTEMATIC MAPPING STUDY.....	1373
<i>Isabelle M. L. Souza, Wilkerson L. Andrade, Livia M. R. Sampaio</i>	
AN INVENTORY OF GOALS FROM CS1 PROGRAMS PROCESSING A DATA SERIES .....	1381
<i>Cruz Izu, Violetta Lonati, Anna Morpurgo, Mario Sanchez</i>	
A NEURO CONTROL TEACHING & LEARNING (T&L) FRAMEWORK FOR IMPROVING LEARNING AND RETENTION IN HIGHER EDUCATION .....	1389
<i>Nabeel A. Murshed, Mohamed Osman, Genanew Bekele, Kamarul Faisal Bin Hashim</i>	

SYSTEMIC CONVERGENCE EDUCATION IN UNDERGRADUATE ECE PROGRAMS.....	1394
<i>R. Alan Cheville, Robert Nickel, Stewart Thomas, Rebecca Thomams, Michael S. Thompson</i>	
STUDENTS' PERCEPTIONS AND BEHAVIOR RELATED TO SECOND-CHANCE TESTING .....	1399
<i>Chinedu Emeka, Timothy Bretl, Geoffrey Herman, Matthew West, Craig Zilles</i>	
FACULTY MEMBERS' CONCEPTUALIZATIONS OF ETHICS IN THE BIOMEDICAL ENGINEERING CLASSROOM.....	1407
<i>Elizabeth A. Sanders, Justin L. Hess, Grant Fore, Mary F. Price, Brandon Sorge, Tom Hahn, Martin Coleman</i>	
IMPROVING THE SUCCESS OF NON-TRADITIONAL STUDENTS IN AN INTRODUCTORY COMPUTING COURSE .....	1412
<i>Christine F. Reilly, Laura M. Grabowski, Gustavo Dietrich</i>	
STUDENT EMOTIONAL RESPONSE TO ORAL ASSESSMENTS IN COMPUTING AND MATHEMATICS.....	1417
<i>Jeremiah Johnson, Karen Jin, Mihaela Sabin</i>	
ESTIMATING THE MULTIPLE SKILLS OF STUDENTS IN MASSIVE PROGRAMMING ENVIRONMENTS .....	1422
<i>Fabiana Zaffalon, André Prisco, Ricardo De Souza, Davi Teixeira, Michel Neves, Jean Luca Bez, Neilor Tonin, Rafael Penna, Silvia Botelho</i>	
FEEDBACK PERCEPTIONS: PRELIMINARY ANALYSIS OF SEMISTRUCTURED GROUP INTERVIEWS WITH FIRST-YEAR BACHELOR STUDENTS OF COMPUTER SCIENCE .....	1429
<i>Ljubov Van Beek, Maartje Van Den Bogaard, Marc De Vries</i>	
CURRICULAR COMPLEXITY OF STUDENT SCHEDULES COMPARED TO A CANONICAL DEGREE ROADMAP .....	1437
<i>Anthony M. Derocchis, Laura E. Boucheron, Mark Garcia, Steven J. Stochaj</i>	
A CORRELATIVE ANALYSIS OF COURSE GRADES AS RELATED TO CURRICULAR PREREQUISITE STRUCTURE AND INTER-CLASS TOPIC DEPENDENCIES.....	1442
<i>Johnathon Nash, Laura E. Boucheron, Steven J. Stochaj</i>	
TOWARDS THE FOURTH INDUSTRIAL REVOLUTION IN NAMIBIA: AN UNDERGRADUATE AI COURSE AFRICANIZED .....	1447
<i>Anastasia Shipepe, Lannie Uwu-Khaeb, Emmanuel Awuni Kolog, Mikko Apiola, Kauna Mufeti, Erkki Sutinen</i>	
INTEGRATING ANDRAGOGY THEORY INTO A MULTIDISCIPLINARY CURRICULUM TO ACHIEVE A CONNECTED PROGRAM FOR A DOCTORATE IN CYBERSECURITY .....	1455
<i>Andrew Hall, Xiang Michelle Liu, Diane Murphy</i>	
DISCONNECTED ENGINEERING EDUCATION .....	1463
<i>Mani Mina, John Heywood</i>	
PRESENTING DO-IT, A METHOD TO TEACH STUDENTS HOW TO PERFORM SYSTEMATIC MAPPINGS - A EXAMPLE CASE OF ITS FIRST USE .....	1466
<i>Pasqueline Dantas Scaico, Alexandre Scaico</i>	
'LET ME SEE WHAT I COULD DO': STUDENTS' EPISTEMIC AFFECT WHEN SOLVING OPEN-ENDED, REAL-WORLD PROBLEMS.....	1472
<i>Jessica Swenson, Emma Treadway, Krista Beranger, Aaron Johnson</i>	

DRIVING TEACHING AND LEARNING IN ONLINE MODE: A CASE STUDY .....	1480
<i>Divya Nalla</i>	
ENCOURAGE STUDENTS TO APPLY THEIR KNOWLEDGE AND THINK “OUT OF THE BOX” WHILE COLLABORATING WITH LOCAL INDUSTRY - CASE STUDY INDUSTRIAL SEMINAR.....	1485
<i>Carolina Islas Sedano, Timo Vasankari</i>	
IGARA: A PROPOSAL FOR A PEDAGOGICAL APPROACH TO APPLY EDUCATIONAL ROBOTICS THROUGH COLLABORATIVE LEARNING .....	1493
<i>Joethe Moraes De Carvalho, José Francisco De Magalhães Netto</i>	
STUDENT CHALLENGES, STRATEGIES, AND LEARNING WITHIN THE DATA MINE LEARNING COMMUNITY .....	1501
<i>Joseph A. Lyon, Aparajita Jaiswal, Alejandra J. Magana, Ellen Gundlach, Mark Daniel Ward</i>	
DEVELOPING A COMIC-CREATION ASSIGNMENT AND RUBRIC FOR TEACHING AND ASSESSING ALGORITHMIC CONCEPTS.....	1508
<i>Briana Bettin, Michelle Jarvie-Eggart, Kelly S. Steelman, Charles Wallace</i>	
LEARNING CIRCLES FOR ENGINEERING EDUCATORS TO NOURISH AND HEAL.....	1513
<i>Lynne A. Slivovsky, Susan M. Lord</i>	
INSIGHTS INTO POWER RELATIONS FROM THE CO-DESIGNING OF CLASSROOM NORMS BETWEEN STUDENTS AND FACULTY.....	1516
<i>Kenya Z. Mejia, Carolyn Donaldson, Mina Zavary, Jennifer Turns</i>	
STUDENT-FACULTY INTERACTIONS TO PROMOTE EQUITY IN ENGINEERING .....	1521
<i>Vandana R. Pamulapati, Allison Godwin, Héctor E Rodríguez-Simmonds, Tara Langus, Justin C. Major, Nelson Pearson, Adam Kirn</i>	
ADOPTION OF PEDAGOGICAL INNOVATIONS: RESOURCE NETWORKS OF ENGINEERING EDUCATION GUILDS .....	1527
<i>Darby Riley, Kaitlin Mallouk, Alexandra Strong, Courtney Faber</i>	
THE RELATIONSHIP BETWEEN EMPATHY AND CIVIC-MINDEDNESS IN FIRST-YEAR ENGINEERING STUDENTS.....	1532
<i>Athena Lin, Justin L. Hess, Aristides P. Carrillo Fernández</i>	
WIP: INTERSECTIONS BETWEEN DIVERSITY, EQUITY, AND INCLUSION (DEI) AND ETHICS IN ENGINEERING.....	1541
<i>Justin L Hess, Andrew Whitehead, Brent K. Jesiek, Andrew Katz, Donna Riley</i>	
NAVIGATIONAL CAPITAL OF AFRICAN AMERICAN STUDENTS IN ENGINEERING AT A PREDOMINANTLY WHITE INSTITUTION .....	1546
<i>Stephanie A. Damas, Lisa C. Benson</i>	
ENGINEERING FACULTY EXPERIENCES TEACHING SOCIAL JUSTICE TO FIRST YEAR STUDENTS.....	1551
<i>Jill Davishahl, Cecile Grubb</i>	
PROMOTING GAME JAMS AND HACKATHONS AS MORE WOMEN-INCLUSIVE ENVIRONMENTS FOR INFORMAL LEARNING .....	1556
<i>Lavinia Paganini, Cláudia Ferraz, Kiev Gama, Carina Alves</i>	

A TOOL SUPPORTED APPROACH FOR TEACHING SERIOUS GAME LEARNING ANALYTICS .....	1565
<i>Victor Manuel Pérez-Colado, Iván José Pérez-Colado, Manuel Freire-Morán, Iván Martínez-Ortiz, Baltasar Fernandez-Manjón</i>	
ALGDYNAMICS: ALGORITHMS AS SYSTEMS.....	1573
<i>Venkatesh Choppella, Kasturi Viswanath, Mrityunjay Kumar</i>	
UNDERSTANDING CAREER IDENTITY DEVELOPMENT AND PREPAREDNESS OF FRESHMEN STUDENTS TO LEVERAGE CONVERGENCE IN ENGINEERING EDUCATION .....	1582
<i>Victor M. Garcia, Diane Elisa Golding, Irma Torres-Catanach, Crystal Cholewa, Helen Geller, Gilberto Moreno, Peter Golding</i>	
SCALABLE LEARNING ENVIRONMENTS FOR TEACHING CYBERSECURITY HANDS-ON.....	1586
<i>Jan Vykopal, Pavel Celeda, Pavel Seda, Valdemar Švábenský, Daniel Tovarnák</i>	
A METHOD FOR EVALUATING A COMPUTING PROGRAM'S CONTINUOUS IMPROVEMENT PLAN .....	1595
<i>Abdullah Azzouni, Jennifer Parham-Mocello</i>	
DOES SELF-EFFICACY CORRELATE WITH POSITIVE EMOTION AND ACADEMIC PERFORMANCE IN COLLABORATIVE LEARNING?.....	1599
<i>Nasrin Dehbozorgi, Mary Lou Maher, Mohsen Dorodchi</i>	
WHAT MAKES COMPUTATIONAL THINKING SO TROUBLESOME? .....	1607
<i>Arnold Pears, Matti Tedre, Teemu Valtonen, Henriikka Vartiainen</i>	
CONSTRUCTIVE ALIGNMENT OF LEARNING OUTCOMES WITH STUDENT PERCEPTIONS IN A FIRST-YEAR ENGINEERING COURSE.....	1614
<i>Siddharth S. Kumar, Jennifer M. Case, David Gray, Nicole Pitterson</i>	
SPECIAL SESSION: FOSTERING WELL-BEING AMID CYCLES OF PROFESSIONAL SHAME IN FACULTY-STUDENT INTERACTIONS .....	1619
<i>James L. Huff, Jeannine E. Turner</i>	
ZEN AND THE ART OF STEAM: STUDENT KNOWLEDGE AND EXPERIENCES IN INTERDISCIPLINARY AND TRADITIONAL ENGINEERING CAPSTONE EXPERIENCES .....	1622
<i>Dominique Dredd, Nadia Kellam, Suren Jayasuriya</i>	
INSPIRING COMPUTATIONAL THINKING: A SCIENCE FAIR ACTIVITY .....	1631
<i>Mats Daniels, Arnold Pears, Aletta Nylén</i>	
STUDENT RESPONSES TO HOMEWORK WRAPPERS.....	1638
<i>Carl R. F. Lund</i>	
RECOMMENDATION MODEL OF PERSONALIZED TEACHING MATERIALS IN E-LEARNING ENVIRONMENTS .....	1642
<i>Thais Oliveira Almeida, José Francisco De Magalhães Netto, Arcanjo Miguel Mota Lopes</i>	
COMPARING TECHNIQUES FOR BUILDING COMMUNITY AND PROMOTING INCLUSION IN A VIRTUAL ENGINEERING CLASSROOM.....	1649
<i>Bridget Benson, Paul Hummel, James Mealy</i>	
AN APPROACH TO DEVELOPING COMPETENCY MODELS FOR PROGRAMMING COURSES.....	1658
<i>Ryan Delane, Steven R. Haynes</i>	

ASSESSING STUDENT PERCEPTIONS OF EMERGING CONCEPTS IN POWER & ENERGY SYSTEMS VIA CONCEPT MAPS: RUBRIC DEVELOPMENT .....	1663
<i>Valentina Cecchi, Courtney Smith-Orr, Forest Atchison, Sukumar Kamalasadán, Paras Mandal, Inez Lopez</i>	
CONSIDERATION FOR SCAFFOLDING OPEN-ENDED ENGINEERING PROBLEMS: INSTRUCTOR REFLECTIONS AFTER THREE YEARS .....	1667
<i>Jessica Swenson, Mary Rola, Aaron Johnson, Emma Treadway, Alice Nitingale, Hoda Koushyar, Jin Woo Lee, Kathryn Wingate</i>	
STUDENTS' TENSIONS IN CHALLENGE-DRIVEN COLLABORATION ACROSS CULTURES .....	1675
<i>Linda Barman</i>	
USE OF AI-GENERATED VISUAL MEDIA IN INTERVIEWS TO UNDERSTAND POWER DIFFERENTIALS IN GENDER, ROMANTIC, AND SEXUAL MINORITY STUDENTS .....	1683
<i>Madeleine Jennings, Jorge Sandoval, Jeanne Sanders, Mirka Koro, Nadia Kellam, Suren Jayasuriya</i>	
DEVELOPING A SOCIAL-ENGINEERING COURSE.....	1687
<i>Ida Ngambeki, Grusha Ahluwalia, Subia Ansari, Minglu Li, Glaris Lancia Raja Arul</i>	
THE EFFECT OF ASSIGNMENT SCAFFOLDING ON ENGINEERING JUDGEMENT .....	1695
<i>Jessica Swenson, Aaron Johnson, John Toftegaard</i>	
USING DISCORD AS AN EXTENSION OF THE EMERGENCY REMOTE TEACHING CLASSROOM DURING THE COVID-19 PANDEMIC .....	1702
<i>Glaucio H. M. Moro, Anderson Vermonde, Artur Mittelbach, Breno Azevedo, Bruno Campagnolo, Claudio Carvilhe, Jose G. Noronha Filho, Mauricio Perin, Carlos N. Silla</i>	
CREATING A CONCEPT MAP FOR ICS SECURITY – A DELPHI STUDY .....	1711
<i>Ida Ngambeki, Eugene Spafford, Subia Ansari, Isslam Alhasan, Marlo Basil-Camino, Douglas Rapp</i>	
HOW STUDENTS TAKE UP OPEN-ENDED, REAL WORLD PROBLEMS .....	1718
<i>Jessica Swenson, Krista Beranger, Aaron W. Johnson</i>	
MULTI-AGENT SYSTEM FOR RECOMMENDING LEARNING OBJECTS IN E-LEARNING ENVIRONMENTS .....	1723
<i>Thais Oliveira Almeida, José Francisco De Magalhães Netto, Arcanjo Miguel Mota Lopes</i>	
CREATING BIOLOGICALLY INSPIRED DESIGN UNITS FOR HIGH SCHOOL ENGINEERING COURSES .....	1728
<i>Roxanne A. Moore, Hoda Ehsan, Euisun Kim, Michael Helms, Meltem Alemdar, Jeffrey Rosen, Christopher J. Cappelli, Marc Weissburg</i>	
USING STRUCTURES, FUNCTIONS, AND MECHANISMS TO ACCESS BIOLOGICAL ANALOGIES: EXPERIENCES FROM HIGH SCHOOL ENGINEERING TEACHERS' PROFESSIONAL DEVELOPMENT .....	1732
<i>Roxanne A. Moore, Hoda Ehsan, Euisun Kim, Michael Helms, Meltem Alemdar, Jeffrey Rosen, Christopher J. Cappelli, Marc Weissburg</i>	
SYSTEM FACTORS AFFECTING UNDERREPRESENTED MINORITIES IN DOCTORAL PROGRAMS IN ENGINEERING: A LITERATURE REVIEW .....	1737
<i>Neirouz Bouhrira, Juan M. Cruz</i>	

COLLABORATIVE INNOVATION: A FRAMEWORK FOR PROMOTING INNOVATION-DRIVEN ENTREPRENEURSHIP ACROSS CAMPUS.....	1741
<i>David Olawale, Paul Talaga, Rhonda Wolverton, Marcos Hashimoto, James Emery</i>	
FROM ADVANCED DIGITAL SIGNAL PROCESSING TO MACHINE LEARNING .....	1749
<i>Jun Zhou, Hen-Geul Yeh</i>	
THE SHIFT FROM STATIC COLLEGE TEXTBOOKS TO CUSTOMIZABLE CONTENT: A CASE STUDY AT ZYBOOKS .....	1758
<i>Chelsea Gordon, Roman Lysecky, Frank Vahid</i>	
A TEMPLATE-BASED SPACED REPETITION LEARNING SOLUTION DESIGNED FOR EDUCATORS.....	1765
<i>Ayman Hajja, Austin J. Hunt</i>	
ASPECT-BASED EMOTION ANALYSIS ON SPEECH FOR PREDICTING PERFORMANCE IN COLLABORATIVE LEARNING .....	1770
<i>Nasrin Dehbozorgi, Divya Pramasani Mohandoss</i>	
EVALUATION OF AN INTERACTIVE TOP HAT TEXT FOR ENGAGED LEARNING .....	1777
<i>Samantha E. Wismer, Lee A. Dosse, Matthew M. Barry</i>	
CULTIVATING AN ADDITIVE INNOVATION CULTURE THROUGH THE COMMUNAL OBSERVATIONS OF NEW EXPERIENCES IN TEACHING (CONEXT) PROTOCOL.....	1782
<i>Cecilia La Place, Jemal Halkiyo, Michael Sheppard, Nadia Kellam, Adam Carberry</i>	
EXPLORATORY STUDY ON ACCURACY OF STUDENTS' MENTAL MODELS OF A SINGLY LINKED LIST .....	1787
<i>Eman Almadhoun, Jennifer Parham-Mocello</i>	
DUALITY AS A CENTRAL ORGANIZING THEME IN LINEAR CIRCUIT ANALYSIS INSTRUCTION .....	1796
<i>B. J. Skromme, M. L. Wong, M. A. O'Donnell</i>	
CREATION OF A FRAMEWORK THAT INTEGRATES TECHNICAL INNOVATION AND LEARNING IN ENGINEERING .....	1805
<i>Lauren Singelmann, Ryan Striker, Enrique Alvarez Vazquez, Ellen Swartz, Mary Pearson, Stanley Shie Ng, Dan Ewert</i>	
ONLINE YET MORE PERSONAL: PROFESSORS RESPOND TO COVID-19 CRISIS .....	1814
<i>Fredy R. Rodriguez-Mejia, Elizabeth K. Briody, Daeyeoul Lee, Edward J. Berger</i>	
QUALITY MODELS AND QUALITY ATTRIBUTES FOR OPEN EDUCATIONAL RESOURCES: A SYSTEMATIC MAPPING .....	1819
<i>Myke Morais De Oliveira, Leo Natan Paschoal, Ellen Francine Barbosa</i>	
LEARNING AND PROFESSIONAL DEVELOPMENT THROUGH INTEGRATED REFLECTIVE ACTIVITIES IN ELECTRICAL AND COMPUTER ENGINEERING COURSES.....	1828
<i>Diane T. Rover, Henry J. Duwe, Mani Mina, Nicholas D. Fila, Phillip H. Jones, Lindsey S. Sleeth</i>	
ANALYZING COLLEGE STUDENTS' ADVISING RECORDS TO IMPROVE RETENTION AND GRADUATION OUTCOME .....	1837
<i>Hui Yang, Apurva D. Pimparkar, Celia Graterol, Rama Ali Kased, Mary Beth Love</i>	

MULTIMEDIA MEETS ARCHAEOLOGY: A NOVEL INTERDISCIPLINARY TEACHING APPROACH.....	1845
<i>Xiaoqing Zhang, Jiaqi Wei, Shengjie Ye, Zunjie Xiao, Yan Hu, Jigen Tang, Jiang Liu</i>	
EDUCATIONAL CONVERGENCE: THE ANTHROPOLOGY, PERFORMANCE, AND TECHNOLOGY (APT) PROGRAM.....	1853
<i>Hortense Gerardo</i>	
IMPACT OF HUMAN SIDE OF ENGINEERING APPROACH IN AN UNDERGRADUATE ELECTROMAGNETICS COURSE .....	1857
<i>Neelam Prabhu Gaunkar, Mani Mina</i>	
DEVELOPING AN INTERDISCIPLINARY PATHWAY FOR ENGINEERING EDUCATION MASTER'S CURRICULUM .....	1861
<i>Kathy L. Jackson, Ivan Esparragoza, Jacquelyn Huff, Paul C. Lynch, Steven Nozaki, Andrea M. Ragonese, Joseph Ranalli, Nancy E. Study</i>	
HELPING ACADEMICALLY TALENTED STEM STUDENTS WITH FINANCIAL NEED SUCCEED.....	1866
<i>Amruth N. Kumar, Maureen Doyle, Victoria Hong, Alark Joshi, Stan Kurkovsky, Sami Rollins</i>	
AN ADAPTIVE LEARNING PATH BUILDER BASED ON A CONTEXT AWARE RECOMMENDER SYSTEM .....	1875
<i>Marianna Carbone, Francesco Colace, Marco Lombardi, Francesco Marongiu, Domenico Santaniello, Carmine Valentino</i>	
MY ROBOT CAN TELL STORIES: INTRODUCING ROBOTICS AND PHYSICAL COMPUTING TO CHILDREN USING DYNAMIC DIOARAMAS.....	1880
<i>Gayathri Manikutty</i>	
ACADEMIC SUCCESS SKILLS IN FIRST-YEAR CHEMICAL ENGINEERS: A BEFORE AND AFTER LOOK AT THE PANDEMIC.....	1889
<i>Kyle F Trenshaw, Rachel Monfredo</i>	
“THE UNDERGRADUATE ENGINEERING COLLABORATIVE GROWTH SERIES”: A DIVERSITY, EQUITY, AND INCLUSION PROGRAM SUPPORTING THE EMPOWERMENT OF MARGINALIZED STUDENTS .....	1895
<i>Corin L. Bowen, Joseph M. Valle, Joi-Lynn Mondisa, Aaron W. Johnson, Jeffrey Sakamoto, Kenneth G. Powell</i>	
ENGINEERING EDUCATION MEETS ORGANIZATIONAL SCIENCE: TOWARD BEST PRACTICES FOR STRATEGIC CHANGE .....	1904
<i>Jesse Pappas, Olga Pierrakos</i>	
HIGHLIGHTING THE BARREN LANDSCAPE OF POSTDOCTORAL RESOURCES: A CONTENT ANALYSIS OF UNIVERSITY WEBSITES .....	1911
<i>Ellen Zerbe, Jia Zhu, Monique Ross, Catherine G. P. Berdanier</i>	
WHAT ROLE SHOULD CHARACTER EDUCATION PLAY IN ENGINEERING EDUCATION? A SPECIAL SESSION TO RETHINK HOW WE EDUCATE THE WHOLE ENGINEER.....	1919
<i>Olga Pierrakos, Adetoun Yeaman, Michael Gross, Jesse Pappas</i>	
ARDUINO BABY PROJECT: ROBOTICS AS A TOOL TO SUPPORT PERMANENCE AND SUCCESS OF TECHNICAL COURSE STUDENTS IN INFORMATICS.....	1923
<i>Joethe Moraes De Carvalho, Euler Viera Da Silva, Elize Farias De Carvalho, José Francisco De Magalhães Netto</i>	

MIXED REALITY LEARNING ENVIRONMENTS IN TIMES OF PANDEMIC: WHAT CAN WE LEARN?.....	1931
<i>Casey May, Mason Grabowski, Simrun Mutha, Raúl Frías Pérez, Sophia Borovikova, Yevgeniya V. Zastavker, Victoria Bennett, Tarek Abdoun, Casper Hartevelde</i>	
SELF-DIRECTED LEARNING READINESS AMONG ENGINEERING STUDENTS DURING EMERGENCY ONLINE INSTRUCTION.....	1936
<i>Mary Katherine Watson, Elise Barrella, Kevin Skenes</i>	
ANALYZING COMPUTER SCIENCE STUDENTS' PERFORMANCE DATA TO IDENTIFY IMPACTFUL CURRICULAR CHANGES.....	1941
<i>Hui Yang, Thomas W. Olson, Arno Puder</i>	
CONDUCTING UNDERGRADUATE RESEARCH ACTIVITIES IN A REMOTE ENVIRONMENT.....	1950
<i>D. W. Parent, T. Hossain, D. King, P. Laguna, S. Gorman</i>	
KITSUNE: STRUCTURALLY AWARE AND ADAPTABLE PLAGIARISM DETECTION .....	1955
<i>Zachary Monroe, Ajay Bansal</i>	
MIRROR MIRROR ON THE WALL - WHAT ARE CYBERSECURITY EDUCATIONAL GAMES OFFERING OVERALL: A RESEARCH STUDY AND GAP ANALYSIS .....	1964
<i>Ankur Chattopadhyay, Chase Maschinot, Laura Nestor</i>	
FULLY REMOTE PROJECT-BASED LEARNING OF HARDWARE/SOFTWARE CODESIGN.....	1972
<i>Rajesh C Panicker, Deepu John</i>	
LOW COST PLATFORM FOR TEACHING AI SELF-DRIVING CARS TOPICS FOR UNDERGRADUATE STUDENTS IN EMERGING COUNTRIES.....	1977
<i>Diego Arce, Jose Balbuena, Diego Quiroz, Hector Oscanoa, Francisco Cuellar</i>	
INTEGRATING ENVIRONMENTAL IMPACT AND GLOBALIZATION INTO SENIOR CAPSTONE COURSES IN MECHANICAL ENGINEERING.....	1983
<i>Patricia Ryaby Backer, Laura Sullivan-Green, Nicole Okamoto, David Parent</i>	
DISPARITY BETWEEN TEXTBOOK EXAMPLES AND WHAT YOUNG STUDENTS FIND INTERESTING.....	1989
<i>Bowen Hui, Parsa Rajabi, Angie Pinchbeck</i>	
PYROBOCAR: A LOW-COST DEEP NEURAL NETWORK-BASED AUTONOMOUS CAR.....	1997
<i>Gordon Hendry, Seth Harris, Ryan Goodwin, Leonid Neverov, Yunkai Xiao, David Tian, Yang Song</i>	
ROLE OF AFFORDANCE, VISUAL DENSITY AND OTHER HCC CRITERIA IN DESIGNING VIRTUAL LEARNING ENVIRONMENTS TO SUPPORT STEM LEARNING FOR AUTISTIC STUDENTS.....	2002
<i>J. Cecil, Mary Sweet-Darter, Aaron Cecil-Xavier, Avinash Gunta</i>	
CHALLENGES AND SUCCESSES OF ENGINEERING INSTRUCTORS WHEN FORCED TO DELIVER COURSES REMOTELY .....	2009
<i>Abdullah Hamad, Abeera P. Rehmat, Grace Panther, Heidi A. Diefes-Dux</i>	
ZOOM EXPERIENCES IN HIGHER EDUCATION: HELPING COLLEGE STUDENTS BUILD DATA VISUALIZATION CAPACITY REMOTELY.....	2016
<i>Vetria L. Byrd</i>	



ASSETS: FOSTERING A COMMUNITY OF ENGINEERING TRANSFER STUDENTS - BEST PRACTICES AND BEYOND .....	2024
<i>Bradley J. Harris, Marclyn D. Porter, Gary H. McDonald, Weidong Wu, Christopher F. Silver, Ignatius Fomunung</i>	
AN EXPERIENTIAL APPROACH TO SUPPORT LEARNING OF CYBER PHYSICAL SYSTEMS CONCEPTS INVOLVING MIXED REALITY PLATFORMS .....	2033
<i>J. Cecil, Avinash Gupta</i>	
ASSIGNMENT PRESENTATION FRAMEWORK FOR CS1 PROGRAMMING PROBLEMS .....	2039
<i>Rita Garcia</i>	
DESCRIPTIVE ANALYTICS DASHBOARD FOR AN INCLUSIVE LEARNING ENVIRONMENT.....	2048
<i>Vladimir Costas-Jauregui, Solomon Sunday Oyelere, Bernardo Caussin-Torrez, Gabriel Barros-Gavilanes, Friday Joseph Agbo, Tapani Toivonen, Regina Motz, Juan Bernardo Tenesaca</i>	
ENGINEERING INSTRUCTORS' SELF-REPORTED EMOTIONS DURING EMERGENCY REMOTE TEACHING .....	2057
<i>Abeera P. Rehmat, Heidi A. Diefes-Dux, Grace Panther</i>	
THE EVOLUTION OF THE E4USA (ENGINEERING FOR US ALL) ENGINEERING CURRICULUM .....	2063
<i>Kenneth J. Reid, Tina M. Griesinger</i>	
CRAFT OF COMPUTING: USING A NOVEL DOMAIN TO BROADEN UNDERGRADUATE PARTICIPATION AND PERCEPTIONS OF COMPUTING AT THE CS0 LEVEL .....	2070
<i>Emily Lovell, James Davis</i>	
ON ENHANCING APPLICATION-ABILITY TRAINING IN DISCRETE MATHEMATICS.....	2079
<i>Tun Li, Wanwei Liu, Liqian Chen, Xiaoguang Mao</i>	
LEARNING AUTONOMOUS DRIVING IN TANGIBLE PRACTICE: DEVELOPMENT AND ON-ROAD APPLICATIONS OF A 1/10-SCALE AUTONOMOUS VEHICLE .....	2084
<i>Laura Paulino, Michelle Zhu, Weitian Wang</i>	
WOMEN IN STEM: HOW CAN WE UNDERSTAND AND SUPPORT THEIR CAREER DEVELOPMENT?.....	2088
<i>Jeri Childers, Tania Machet, Michelle Duval</i>	
ACTIVE LISTENING FOR ENGINEERING STUDENTS.....	2095
<i>David Novick, Melanie Realyvasquez, Nicholas A. Ramirez</i>	
SCAFFOLDING STUDENT SUCCESS IN THE WILDS OF OPEN SOURCE CONTRIBUTION.....	2099
<i>Emily Lovell, James Davis</i>	
A CUSTOMIZED AND AUTOMATED ASSIGNMENT MANAGEMENT AND MARKING SYSTEM FOR EVALUATING STUDENT PERFORMANCE IN THE STEM DISCIPLINES .....	2104
<i>Ashkan Shokri, Veronica Halupka, Valentijn R. N. Pauwels</i>	
DESIGN THE FUTURE ACTIVITIES (DFA): TYPOLOGY OF CONTENT FOR CASE STUDIES .....	2108
<i>Hadi Ali</i>	

THE “MUDDIEST POINT” IN UNDERGRADUATE RESEARCH: A SURVEY ON STUDENTS AND FACULTY ABOUT EXISTING CHALLENGES.....	2112
<i>Yuezhou Wang, Jennifer Karlin</i>	
EXAMINING THEORETICAL AND PEDAGOGICAL FOUNDATIONS OF COMPUTATIONAL THINKING IN THE CONTEXT OF HIGHER EDUCATION.....	2117
<i>Friday Joseph Agbo, Samuel T. Yigzaw, Ismaila Temitayo Sanusi, Solomon Sunday Oyelere, Alem Habte Mare</i>	
FACULTY DEVELOPMENT MODEL FOR MENTORING INTERDISCIPLINARY ENGINEERING PROJECTS.....	2125
<i>Unnati Koppikar, Kaushik Mallibat, Rohit Kanadakatla, Gopalkrishna Joshi, Vijayalakshmi M</i>	
WHAT YOU SEE IS WHAT YOU GET? – RELATING EYE-TRACKING METRICS TO STUDENTS' ATTENTION TO GAME ELEMENTS.....	2130
<i>Amirbahador Shojaee, Hyeon Woo Kim, Kimberly Cook-Chennault, Idalis Villanueva Alarcon</i>	
WHAT INFORMAL LEARNING PROGRAMS TEACH US ABOUT ADAPTATION TO CONTACTLESS AND REMOTE LEARNING ENVIRONMENTS .....	2136
<i>Kimberly Cook-Chennault, Danielle Cummings, Marcus Anthony, Tejaskumar Balar, Laura Uzzell, Sheryle Boone, Crystal Watson</i>	
A JOURNEY THAT MOTIVATES: EXPLORING THE ASSOCIATE STUDENTS TRANSITION FRAMEWORK .....	2144
<i>Debbie Meharg, Alison Varey, Sandra Cairncross</i>	
APPROPRIATE EVALUATIONS OF APPLICANTS' DIVERSITY STATEMENTS FOR IMPROVED INCLUSIVITY AND CONVERGENT THINKING .....	2151
<i>Karan L. Watson, Stephanie G. Adams, P. K. Imbrie, Teri K. Reed, Carmen K. Sidbury, Bevlee A. Watford</i>	
USING THE S-STEM PROGRAMMATIC LENS TO INVESTIGATE EQUITY IN A COMPUTER SCIENCE DEPARTMENT .....	2154
<i>Sarah Hug, Mark McKay, Megan Thomas, Tom Carter, Melanie Martin</i>	
SURVEY OF RESOURCES FOR INTRODUCING MACHINE LEARNING IN K-12 CONTEXT .....	2160
<i>Ismaila Temitayo Sanusi, Solomon Sunday Oyelere, Friday Joseph Agbo, Jarkko Suhonen</i>	
NAVIGATING AND RECONCILING IDENTITY INTERFERENCE AND VALUES CONFLICTS ASSOCIATED WITH OUR ENGINEERING IDENTITIES: A CONCEPTUAL FRAMEWORK.....	2169
<i>Meagan R. Kendall, Cole Joslyn</i>	
EXPLORING THE IMPACT OF NON-CONVENTIONAL GAMIFICATION ELEMENTS ON STUDENT MOTIVATION AND ENGAGEMENT .....	2174
<i>Darina Dicheva, Christo Dichev, Lillian Cassel, Breonte Guy, Keith Irwin</i>	
INVESTIGATING CO-AUTHORSHIP, RESEARCH THEMES, AND FUNDING STREAMS FOR THE FRONTIERS IN EDUCATION COMMUNITY.....	2183
<i>Rebecca Rosenblatt</i>	
A DRAMATURGICAL EXPLORATION OF ENGINEERING JUDGMENT PROCESSES IN UNDERGRADUATE STUDENT WRITING .....	2192
<i>Royce Francis, Rachel Riedner, Marie Paretti</i>	

PACT: A CITIZEN SCIENCE PROJECT FOR COMPUTING EDUCATION.....	2201
<i>Braz Araujo Da Silva, Simone André Da Costa Cavalheiro, Luciana Foss, Ana Marilza Pernas Fleischmann, Andrea Volz Garcez</i>	
EXPERIENTIAL LEARNING FOR TEACHING HEATING, VENTILATION, AND AIR- CONDITIONING ENGINEERING.....	2210
<i>James Butler, David P. Yuill</i>	
FACILITATING THE GENERATION OF PARAMETRIC QUESTIONS AND THEIR EXPORT TO MOODLE.....	2215
<i>Francisco De Assis Zampirolli, Valério Ramos Batista, Edson Pimentel, Juliana Braga</i>	
SHIFTING GOALS IN INTRODUCTORY AND ADVANCED COMPUTER SCIENCE COURSES: THE EFFECTS OF GENDER AND MAJOR .....	2223
<i>Markeya S. Peteranetz</i>	
DETERMINING THE STUDENTS' PREFERABLE LEARNING MODE FOR BOTH TRADITIONAL CLASSROOMS TEACHING UNDER NORMAL SITUATIONS AND FORCED VIRTUAL TEACHING IN QUARANTINE PERIOD .....	2231
<i>Mankirat Singh, Edward Clay, Yasser Salem, Wen Cheng</i>	
MOTIVATIONAL FACTORS INFLUENCING ENGINEERING FACULTY'S PURSUIT OF INSTRUCTIONAL FACULTY POSITIONS AT HISPANIC-SERVING INSTITUTIONS .....	2239
<i>Yamile A. Urquidi Cerros, Mais Kayyali, Meagan R. Kendall, Alexandra Coso Strong</i>	
USE OF VIRTUAL REALITY TO IMPROVE ENGAGEMENT AND SELF-EFFICACY IN ARCHITECTURAL ENGINEERING DISCIPLINES .....	2244
<i>Ece Erdogmus, Erica Ryherd, Heidi A. Diefes-Dux, Catherine Armwood-Gordon</i>	
TIME AS A CHALLENGE FOR HIGHER EDUCATION INSTITUTIONS AND EMPLOYERS .....	2251
<i>Rosa Vasconcelos, Emilia Araújo, Nélia Lima</i>	
ONLINE STUDENT SUPERVISION: A REFLECTIVE STUDY ON LESSONS AND CHALLENGES.....	2256
<i>Ali Ahmed, Craig Watterson, Karsten Lundqvist, Jennifer Ferreira</i>	
PYDASH - A FRAMEWORK BASED EDUCATIONAL TOOL FOR ADAPTIVE STREAMING VIDEO ALGORITHMS STUDY .....	2263
<i>Marcelo A. Marotta, Gustavo C. Souza, Maristela Holanda, Marcos F. Caetano</i>	
TEACHERS' PERSPECTIVE ON IMPLEMENTING COMPUTATIONAL THINKING IN ELEMENTARY CLASSROOMS .....	2271
<i>Shi Feng, Dazhi Yang</i>	
AN OVERVIEW ON THE USE OF EDUCATIONAL DATA MINING FOR CONSTRUCTING RECOMMENDATION SYSTEMS TO MITIGATE RETENTION IN HIGHER EDUCATION.....	2276
<i>Thiago Nazareth De Oliveira, Flavia Bernardini, José Viterbo</i>	
THE USE OF INTERACTIVE SCREENCASTS TO PROMOTE ACTIVE AND ENGAGED LEARNING IN THE FURTHER EDUCATION MATHEMATICS CLASSROOM: A DESCRIPTIVE CASE STUDY FROM NORTH EAST ENGLAND .....	2283
<i>Raphael Eichie, Rebecca Strachan</i>	
RELATIONSHIP BETWEEN LEARNING ENGAGEMENT METRICS AND LEARNING OUTCOMES IN ONLINE ENGINEERING COURSE .....	2288
<i>Tiantian Li, Laura Melissa Cruz Castro, Kerrie Douglas, Christopher G. Brinton</i>	

WORK IN PROGRESS: A STUDY OF VARIATIONS IN MOTIVATION AND EFFICACY FOR COMPUTATIONAL MODELING IN FIRST-YEAR ENGINEERING STUDENTS.....	2293
<i>Alison Polasik, Anna Suggs, Rachel Kaifez</i>	
BASKIN ENGINEERING EXCELLENCE SCHOLARS BRIDGE PROGRAM: PLANNING, IMPLEMENTATION, AND EVALUATION.....	2299
<i>Narges Norouzi, Carmen Robinson, Rebecca Covarrubias, Ruby Hernandez, Danay Weldegabriel, Gwynn Benner, Wenjuan Sang, Rafael Espericueta</i>	
A METALEARNING APPROACH TO PERSONALIZED AUTOMATIC ASSESSMENT OF RECTILINEAR SKETCHES.....	2307
<i>Laura Melissa Cruz Castro, Samantha Ray, Hillary E. Merzdorf, Kerrie A. Douglas, Tracy Hammond</i>	
A SYSTEMICALLY SYNERGISTIC APPROACH TO THE DESIGN OF INTEGRATIVE ADVANCED TRAINING COURSES IN THE FIELD OF CROSS-CUTTING TECHNOLOGIES.....	2313
<i>Alexey Dukhanov, Anna Lutsenko, Alexandra Klimova, Simon Kraev</i>	
A NOVEL COLLABORATIVE ONLINE ROBOTICS PLATFORM TO ADDRESS ENGAGEMENT AND SOCIAL EMOTIONAL CHALLENGES IN REMOTE LEARNING ENVIRONMENT.....	2322
<i>Olga Sans-Cope, Ethan Danahy, Daniel Hannon, Chris Rogers, Jordi Albo-Canals, Cecilio Angulo</i>	
A SCRUM-BASED METHOD FOR AUTONOMOUS LEARNING MANAGEMENT .....	2327
<i>Higor Oliveira, Cristiano Araújo, Kiev Gama</i>	
FOSTERING DIGITAL LITERACY THROUGH ACTIVE LEARNING IN ENGINEERING EDUCATION.....	2336
<i>Patricia Caratozzolo, Alvaro Alvarez-Delgado, Gabriela Sirkis</i>	
SKETCHING ASSESSMENT IN ENGINEERING EDUCATION: A SYSTEMATIC LITERATURE REVIEW .....	2342
<i>Hillary E. Merzdorf, Morgan Weaver, Donna Jaison, Tracy Hammond, Julie Linsey, Kerrie A. Douglas</i>	
SIMINT: A STRUCTURED EXPERIENCE TO DEVELOP MATURE ENGINEERING MINDSET .....	2347
<i>Ruben Acuña, Ajay Bansal</i>	
ENGINEERING INSTRUCTIONAL FACULTY PERCEPTIONS OF STUDENTS' BACKGROUND AT HISPANIC SERVING INSTITUTIONS.....	2352
<i>Valerie Bracho Perez, Henry Salgado, Alexandra Coso Strong, Meagan R. Kendall</i>	
ONLINE ACCESS AND CONTROL OF LABORATORY STATIONS USING VIDEO CONFERENCE SYSTEMS.....	2357
<i>Luis Felipe Zapata-Rivera, Catalina Aranzazu-Suescun, Maria M. Larrondo-Petrie</i>	
A REMOTE/VIRTUAL ROBOTICS LAB.....	2364
<i>R. Pito Salas, Julian Ho</i>	
NON-INTRUSIVE CLASSROOM ATTENTION TRACKING SYSTEM (NICATS).....	2368
<i>Andrew Sanders, Bradley Boswell, Gursimran Singh Walia, Andrew Allen</i>	
STARTING WITH THE PROMISES: MOVING FROM INSPIRATIONAL WORDS TO INSTITUTIONAL ACTION IN ADDRESSING SYSTEMIC RACISM .....	2377
<i>Brooke Coley, James Holly</i>	

STUDENT PREFERENCE: ONLINE OR FACE-TO-FACE INSTRUCTION IN A YEAR OF COVID-19 .....	2381
<i>Jon Sticklen, S. L. Amato-Henderson</i>	
GENDERED LEARNING: HOW CONSTRUCTS OF KNOWLEDGE IMPACT ENGINEERING STUDENTS' SENSE OF BELONGING .....	2387
<i>Ramona Smucker, Lizette Ortega, Yevgeniya Zastavker</i>	
AN ARCHITECTURE MODEL OF RECOMMENDER SYSTEM FOR PEDAGOGICAL DESIGN PATTERNS .....	2392
<i>Nasrin Dehbozorgi, Alan Norkham</i>	
UNCOVERING GENERATIVE DESIGN RATIONALE IN THE UNDERGRADUATE CLASSROOM.....	2396
<i>Molly H. Goldstein, James Sommer, Natascha Trellinger Buswell, Xingang Li, Zhenghui Sha, H. Onan Demirel</i>	
APPLICATION OF SOURCE CODE PLAGIARISM DETECTION AND GROUPING TECHNIQUES FOR SHORT PROGRAMS .....	2402
<i>Dylan Ryman, P. K. Imbrie, Jeff Kastner</i>	
HOW TO MEASURE THE INNOVATIVENESS AND ENTREPRENEURSHIP FEATURES OF A CURRICULUM?.....	2409
<i>Asad Azemi</i>	
TRANSITIONING FROM FACULTY-CENTERED TO STUDENT-CENTERED COMMUNICATION .....	2414
<i>Rebecca Rosenblatt, Rebecca Lindell</i>	
ENHANCING INTERACTIVE LEARNING IN ENGINEERING CLASSES BY IMPLEMENTING VIRTUAL LABORATORIES .....	2417
<i>Maziar Ghazinejad, Farbod Khoshnoud, Stephen Porter</i>	
USE OF GAMES TO TEACH TEAMWORK AND COMMUNICATION SKILLS TO ENGINEERING STUDENTS.....	2422
<i>Matthew Nelson, Benjamin Ahn</i>	
CONTEXTUALIZING MICRO HIGH PERFORMANCE COMPUTING ARTIFACTS IN HIGHER EDUCATION.....	2431
<i>Nkundwe Moses Mwasaga, Mike Joy</i>	
ECHELON: AN AI TOOL FOR CLUSTERING STUDENT-WRITTEN SQL QUERIES.....	2440
<i>Matthew Weston, Haorong Sun, Geoffrey L Herman, Hisham Benotman, Abdussalam Alawini</i>	
WHAT INFORMAL LEARNING PROGRAMS TEACH US ABOUT ADAPTATION TO CONTACTLESS AND REMOTE LEARNING ENVIRONMENTS .....	2448
<i>Kimberly Cook-Chennault, Danielle Cummings, Marcus Anthony, Tejaskumar Balar, Laura Izzell, Sheryle Boone, Crystal Watson</i>	
CONTENT ANALYSIS OF THE FACULTY OF TECHNOLOGY'S CURRICULUM - ADDRESSING THE DIMENSIONS OF MULTIDISCIPLINARITY, INDUSTRY COLLABORATION AND SUSTAINABILITY .....	2456
<i>Carolina Islas Sedano, Sari Stenvall-Virtanen</i>	

**Author Index**