Lecture Notes in Networks and Systems

Volume 269

Series Editor

Janusz Kacprzyk, Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland

Advisory Editors

Fernando Gomide, Department of Computer Engineering and Automation—DCA, School of Electrical and Computer Engineering—FEEC, University of Campinas—UNICAMP, São Paulo, Brazil

Okyay Kaynak, Department of Electrical and Electronic Engineering, Bogazici University, Istanbul, Turkey

Derong Liu, Department of Electrical and Computer Engineering, University of Illinois at Chicago, Chicago, USA; Institute of Automation, Chinese Academy of Sciences, Beijing, China

Witold Pedrycz, Department of Electrical and Computer Engineering, University of Alberta, Alberta, Canada; Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland

Marios M. Polycarpou, Department of Electrical and Computer Engineering, KIOS Research Center for Intelligent Systems and Networks, University of Cyprus, Nicosia, Cyprus

Imre J. Rudas, Óbuda University, Budapest, Hungary

Jun Wang, Department of Computer Science, City University of Hong Kong, Kowloon, Hong Kong

The series "Lecture Notes in Networks and Systems" publishes the latest developments in Networks and Systems—quickly, informally and with high quality. Original research reported in proceedings and post-proceedings represents the core of LNNS.

Volumes published in LNNS embrace all aspects and subfields of, as well as new challenges in, Networks and Systems.

The series contains proceedings and edited volumes in systems and networks, spanning the areas of Cyber-Physical Systems, Autonomous Systems, Sensor Networks, Control Systems, Energy Systems, Automotive Systems, Biological Systems, Vehicular Networking and Connected Vehicles, Aerospace Systems, Automation, Manufacturing, Smart Grids, Nonlinear Systems, Power Systems, Robotics, Social Systems, Economic Systems and other. Of particular value to both the contributors and the readership are the short publication timeframe and the world-wide distribution and exposure which enable both a wide and rapid dissemination of research output.

The series covers the theory, applications, and perspectives on the state of the art and future developments relevant to systems and networks, decision making, control, complex processes and related areas, as embedded in the fields of interdisciplinary and applied sciences, engineering, computer science, physics, economics, social, and life sciences, as well as the paradigms and methodologies behind them.

Indexed by SCOPUS, INSPEC, WTI Frankfurt eG, zbMATH, SCImago.

All books published in the series are submitted for consideration in Web of Science.

More information about this series at http://www.springer.com/series/15179

Salman Nazir · Tareq Z. Ahram ·
Waldemar Karwowski
Editors

Advances in Human Factors in Training, Education, and Learning Sciences

Proceedings of the AHFE 2021 Virtual Conference on Human Factors in Training, Education, and Learning Sciences, July 25–29, 2021, USA

Springer

Editors
Salman Nazir
Institute of Maritime Operations
University of South-Eastern Norway
Borre, Norway

Tareq Z. Ahram
Institute for Advanced Systems Engineering
University of Central Florida
Orlando, FL, USA

Waldemar Karwowski
Department of Industrial Engineering
and Management System
University of Central Florida
Orlando, FL, USA

ISSN 2367-3370 ISSN 2367-3389 (electronic)
Lecture Notes in Networks and Systems
ISBN 978-3-030-79999-1 ISBN 978-3-030-80000-0 (eBook)
https://doi.org/10.1007/978-3-030-80000-0

© The Editor(s) (if applicable) and The Author(s), under exclusive license
to Springer Nature Switzerland AG 2021
This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Advances in Human Factors and Ergonomics 2021

AHFE 2021 Series Editors

Tareq Z. Ahram, Florida, USA
Waldemar Karwowski, Florida, USA

12th International Conference on Applied Human Factors and Ergonomics and the Affiliated Conferences (AHFE 2021)

Proceedings of the AHFE 2021 Virtual Conference on Human Factors in Training, Education, and Learning Sciences, July 25–29, 2021, USA.

Advances in Neuroergonomics and Cognitive Engineering	Hasan Ayaz, Umer Asgher and Lucas Paletta
Advances in Industrial Design	Cliff Sungsoo Shin, Giuseppe Di Bucchianico, Shuichi Fukuda, Yong-Gyun Ghim, Gianni Montagna and Cristina Carvalho
Advances in Ergonomics in Design	Francisco Rebelo
Advances in Safety Management and Human Performance	Pedro M. Arezes and Ronald L. Boring
Advances in Human Factors and Ergonomics in Healthcare and Medical Devices	Jay Kalra, Nancy J. Lightner and Redha Taiar
Advances in Simulation and Digital Human Modeling	Julia L. Wright, Daniel Barber, Sofia Scataglin and Sudhakar L. Rajulu
Advances in Human Factors and System Interactions	Isabel L. Nunes
Advances in the Human Side of Service Engineering	Christine Leitner, Walter Ganz, Debra Satterfield and Clara Bassano
Advances in Human Factors, Business Management and Leadership	Jussi Ilari Kantola, Salman Nazir and Vesa Salminen
Advances in Human Factors in Robots, Unmanned Systems and Cybersecurity	Matteo Zallio, Carlos Raymundo Ibañez and Jesus Hechavarria Hernandez
Advances in Human Factors in Training, Education, and Learning Sciences	Salman Nazir, Tareq Z. Ahram and Waldemar Karwowski

(continued)

(continued)

Advances in Human Aspects of Transportation	Neville Stanton
Advances in Artificial Intelligence, Software and Systems Engineering	Tareq Z. Ahram, Waldemar Karwowski and Jay Kalra
Advances in Human Factors in Architecture, Sustainable Urban Planning and Infrastructure	Jerzy Charytonowicz, Alicja Maciejko and Christianne S. Falcão
Advances in Physical, Social & Occupational Ergonomics	Ravindra S. Goonetilleke, Shuping Xiong, Henrijs Kalkis, Zenija Roja, Waldemar Karwowski and Atsuo Murata
Advances in Manufacturing, Production Management and Process Control	Stefan Trzcielinski, Beata Mrugalska, Waldemar Karwowski, Emilio Rossi and Massimo Di Nicolantonio
Advances in Usability, User Experience, Wearable and Assistive Technology	Tareq Z. Ahram and Christianne S. Falcão
Advances in Creativity, Innovation, Entrepreneurship and Communication of Design	Evangelos Markopoulos, Ravindra S. Goonetilleke, Amic G. Ho and Yan Luximon
Advances in Human Dynamics for the Development of Contemporary Societies	Daniel Raposo, Nuno Martins and Daniel Brandão

Preface

This book provides researchers and practitioners a forum to share research and best practices in the application of human factors to training, education, and learning sciences. Just as human factors' discipline has been applied to hardware, software, and the built environment, there is now a growing interest in the optimal design of training, education, and learning experiences. Principles of behavioral and cognitive science are extremely relevant to the design of instructional content and the effective application of technology to deliver the appropriate learning experience. These principles and best practices are important in corporate, higher education, and military training environments.

This book also aims to share and transfer not just knowledge, learning experiences, and best training approaches that are of real value in practical terms, a value that can help leaders ensure their organizations stay ahead of the competition through continued innovation, strong competitive advantage, and inspired leadership.

This book is organized into nine sections that contain the following subject areas:

1. Advanced Learning Technologies
2. Implementation of Learning Technologies in Education
3. Novel Technology and Methods for Training and Certification
4. Interactive Multimedia and Gamification
5. Student Training and Environment Interaction
6. Analysis of Learning Strategies and Learning Performance
7. Teaching and Learning
8. Distance Learning during COVID-19 Era
9. Competency and Skill Management in Education

Each section contains research papers that have been reviewed by the members of the International Editorial Board. Our sincere thanks and appreciation to the board members as listed below:

S. Abramovich, USA
D. Al Thani, Qatar
T. Alexander, Germany
T. Barath, Hungary
J. Bartnicka, Poland
J. Castro-Alonso, Chile
J. Elliott, USA
M. Freeman, USA
Gronstedt, USA
Madinger, USA
S. Mallam, Norway
Mansoor, Qatar
McClernon, USA
K. Moore, USA
K. Orvis, USA
B. Pokorny, USA
R. Roper, USA
Sampson, Greece
J. Smith, Canada
J. Syversen, Norway

July 2021

Salman Nazir
Tareq Z. Ahram
Waldemar Karwowski

Contents

Advanced Learning Technologies

Structure of a Socio-Technical Learning and Innovation Factory 3
Barbara Tropschuh, Fabian Dillinger, Quirin Gärtner, Svenja Korder, Harald Bauer, and Moritz Kagerer

Teaching Robotics with Virtual Reality: Developing Curriculum for the 21st Century Workforce 12
Eric Peterson, Biayna Bogosian, Jorge Tubella, and Shahin Vassigh

I Feel the Need for Speed: Empirical Evidence of the Effectiveness of VR Training Technology on Knowledge and Skill Acquisition 19
Victoria Trabysh, T. J. Feldhacker, Cait Rizzardo, Jake Johnson, Lisa Tripp, Kent Halverson, and Antonio Gonzalez III

Digital Creative Abilities for Achieving Digital Maturity 27
Mara Rita Canina and Carmen Bruno

AI and Learning in the Context of Digital Transformation 36
Martin Kröll and Kristina Burova-Keßler

Impacts on Cognitive Decay and Memory Recall During Long Duration Spaceflight 44
Terry Rector, Curtis Cripe, and James Casler

Implementation of Learning Technologies in Education

Spiritual Accompaniment Training in Pediatric Palliative Care: A Case Study from Spain 55
Florentin Popescu, Mario Gabriel Ciccorossi, Inma Ferrer Svoboda, and Pau Miquel Diego

Evolution of an Approach for Digital Learning and Training in Nursing 63
Jan A. Neuhöfer, Tim Wöllenstein, and Sabine Hansen

A Human-Centered Approach for an Autism-Friendly Drawn Space 71
Anna Lisa Pecora, Erminia Attaianese, and Alessandra Pagliano

An Interactive Guide Based on Learning Objects to Train Teachers on the Detection and Support of Children with Attention Deficit Hyperactivity Disorder 78
Karina Parra-Luzuriaga, Yaroslava Robles-Bykbaev, Vladimir Robles-Bykbaev, and Paúl León-Goméz

Application of Assessment-Analytic Knowledge Building Tools in Collaborative Creative Studies 84
Amic G. Ho

Novel Technology and Methods for Training and Certification

Non-technical Skills Training in Crew Resource Management: Curating YouTube Videos for Educational Purposes 93
Charlott Sellberg, Gesa Praetorius, and Marin Viktorelius

Exploration of Team Communication Behaviors from a Live Training Event 101
Jason D. Saville, Randall D. Spain, Joan H. Johnston, and James C. Lester

Blended Learning. Exploring Contradictory Demands Between Emerging Design Principles and New Learning Practices 109
Astrid Camilla Wiig

Kaizen Method Applied in Higher Education: Case Study of Autonomous University of Baja California 122
Susana Zambrano-López, María Marcela Solís-Quinteros, Carolina Zayas-Márquez, and Luis Alfredo Ávila-López

Interactive Multimedia and Gamification

Gamification Strategies to Teach Algorithmic Thinking to First Graders 133
Roberto Araya

Changing Children's Behavior Based on Persuasive Game: Design for Children's Safety Education 142
Yanan Yang, Duoduo Zhang, Xiaoqian Mou, and Yuanyuan Yang

Augmented Reality Teaching Resources and Its Implementation in the Teaching-Learning Process 149
Omar Cóndor-Herrera, Pamela Acosta-Rodas, and Carlos Ramos-Galarza

Student Training and Environment Interaction

Design Approach of Digital Numeration Training for Students in a Primary School 157
Adrian Roussel-Fayard, Nadine Vigouroux, Frédéric Vella, Jean-François Camps, and Charlotte Tabarant

Risks to Student Achievement in Higher Education 165
Angela Atwell, Bettina Mrusek, Jim Solti, and Keith Wilson

Participants' Perspectives on Design-Build Experience: A Qualitative Exploration 173
Shweta Saxena, Sandeep Arora, and Rachna Khare

Analysis of Learning Strategies and Learning Performance

Reforming Professional Education: A Case of Cognitive Human Factor/Human Element in Shipping Industry 183
Gholam Reza Emad

The Effect of Student Learning Style and Lesson Structure on Student Outcomes in an Online Learning Environment 190
Matthew R. Romoser

Analysis of Generic Competences Needed Onboard a Ship 199
Ana Gundić, Dino Županović, Dalibor Ivanišević, and Luka Grbić

Admission Points Score Predicting Undergraduate Performance – Comparing Quantity Surveying vs. Construction Management 208
Danie Hoffman, Inge Pieterse, and Derick Booyens

Mapping Aspects for Assessing Aptitude for Architecture Education with Psychological Testing 215
Poonam Khan and Nikhil Ranjan Mandal

Construction Competence Model of Music Appreciation Course Teachers in Science and Engineering University 223
Yingxin Guan, Songqi Fei, Yaning Zhao, and Yihang Du

The APS and Undergraduate Performance in Construction Economics in South Africa 232
Danie Hoffman

Teaching and Learning

MOOC Courses as a Tool for the Development of Digital Competencies of Teachers 243
Petr Svoboda and Lenka Mynaříková

Online Mentoring Platform for Developing Leaders of Character 252
Terence Andre, David Huston, Anne-Marie Ireland, Andrew Stewart, Rod Ford, Christy Carr, and Hannah Staller

Architectural Design for the Implementation of Learning Analytics: Case Study at Salesian Polytechnic University 260
Santiago Teodoro Castro Arias, Miguel Angel Quiroz Martinez, Maikel Yelandi Leyva Vazquez, and Angela Cecilia Flores Ortiz

Activity Design of Nature Experience Teaching 269
Rong-Lin Zhou and Ding-Bang Luh

Teaching of Design: Emphasis on Research of Media Characteristics 276
Ming Lei and Shengzhao Yu

Distance Learning during COVID-19 Era

Online Classes: Lessons Learned During the Pandemic 287
Angela Caridà, Maria Colurcio, Ambra Altimari, and Monia Melia

Ergonomics of Virtual Learning During COVID-19 299
Lu Yuan and Alison Garaudy

Information Competency as a Success Factor in Distance Learning 307
Tatiana Shaposhnikova, Alexander Gerashchenko, and Dmitry Romanov

Evaluation of Distance Learning Effects on Concentration and Relaxed States by EEG and HRV 315
Yuri Nakagawa, Peeraya Sripian, and Midori Sugaya

E-learning Ergonomic Challenges During the Covid-19 Pandemic 324
Noemí Suárez Monzón, Janio Jadán-Guerrero, Reinaldo Requeiro Almeida, and Karina Elizabeth Delgado Valdivieso

E-learning and M-learning Benefits in the Learning Process 331
Omar Cóndor-Herrera, Mónica Bolaños-Pasquel, and Carlos Ramos-Galarza

Evaluation of Achievement Effect on Visual Tools for Online Teaching-Learning Program in China During the Covid-19 Pandemic 337
Wenyu Wu, Ziwei He, Xinran Yan, Zijian Han, Yaning Li, and Chengqi Xue

Competency and Skill Management in Education

Topic Mapping to Support Users in Literature Search 345
Ethan B. Trewhitt, Elizabeth T. Whitaker, Robert E. Wray, and Dawn Riddle

An Analysis of the Relationship Between Goal Change and Skill Improvement in the Consumption of Education Services: A Case Study of the Management Game 353
Kazuhiro Fujimura

Supporting Users in Review and Analysis of Academic Literature 362
Robert E. Wray, Elizabeth T. Whitaker, Dawn Riddle, Tyree Cowell, Timothy Siggins, and Ethan B. Trewhitt

Application of Virtual Simulation Experimental System of Curtain Wall Based on Educational Transformation and Upgrading 371
Chenguang Ma and Manhai Li

Innovative Forms of Social Non-formal Youth Education 379
Nataliia Levchenko, Yuliya Klymenko, Olena Baldyniuk, Svitlana Roienko, and Nataliia Koliada

An Examination of the Effect of Common Language on the Creation of a Sense of Unity Between Organization Members in a Management Game 387
Fumiyo Ozaki and Kazuhiro Fujimura

Author Index 397