Volume	19	Number	3	2021



World Transactions on Engineering and Technology Education

Editor-in-Chief Zenon J. Pudlowski World Institute for Engineering and Technology Education (WIETE) Melbourne, Australia

> Guest Editor Pavel Gregor Slovak University of Technology in Bratislava Bratislava, Slovakia

Melbourne 2021	
_	

World Transactions on Engineering and Technology Education



Commonwealth Science and Technology Academy for Research (C-STAR) Chennai, India



Faculty of Architecture Cracow University of Technology Kraków, Poland



Faculty of Architecture Gdańsk University of Technology Gdańsk, Poland



Faculty of Architecture and Design Slovak University of Technology in Bratislava Bratislava, Slovakia



Faculty of Architecture Wrocław University of Science and Technology Wrocław, Poland

Published by:

World Institute for Engineering and Technology Education (WIETE) 141 The Boulevard, Ivanhoe East, Melbourne, VIC 3079, Australia

E-mail: <u>info@wiete.com.au</u>
Internet: <u>http://www.wiete.com.au</u>

© 2021 WIETE

ISSN 1446-2257

Articles published in the World Transactions on Engineering and Technology Education (WTE&TE) have undergone a formal and rigorous process of peer review by international referees.

This Journal is copyright. Apart from any fair dealing for the purpose of private study, research, criticism or review as permitted under the Copyright Act, no part of this Journal may be reproduced by any process without the written permission of the publisher.

Responsibility for the contents of these articles rests upon the authors and not the publisher. Data presented and conclusions developed by the authors are for information only and are not intended for use without independent substantiating investigations on the part of the potential user.

World Transactions on Engineering and Technology Education

EDITOR-IN-CHIEF

Prof. Zenon J. Pudlowski World Institute for Engineering and Technology Education (WIETE)

141 The Boulevard, Ivanhoe East, Melbourne, VIC 3079, Australia Tel/Fax: +61 3 94994339, E-mail: zenon.pudlowski@wiete.com.au

Internet: http://www.wiete.com.au

MANAGER & ASSOCIATE

EDITOR

Dr Dianne Q. Nguyen World Institute for Engineering and Technology Education (WIETE),

Melbourne, Australia

ASSOCIATE EDITORS

Mrs Dorota I. Pudlowski World Institute for Engineering and Technology Education (WIETE),

Melbourne, Australia

A/Prof. Arthur J. Swart

Prof. Robert Špaček

Mr Nial Wareing

Central University of Technology, Bloemfontein, Free State, South Africa
Slovak University of Technology in Bratislava, Bratislava, Slovakia
University Lecturer (Ret.), Tetbury, Gloucestershire, England, UK

ADVISORY BOARD MEMBERS

A/Prof. Stanislav Avsec University of Ljubljana, Ljubljana, Slovenia

A/Prof. Kristijan Breznik International School for Social and Business Studies; College of Industrial

Engineering, Celje, Slovenia

Prof. Colin U. Chisholm

Or Luis M. Dos Santos

Glasgow Caledonian University, Glasgow, Scotland, UK

Woosong University, Daejeon, Republic of Korea

Prof. Barbara E. Gronostajska Wrocław University of Science and Technology, Wrocław, Poland

Prof. Ahmad Ibrahim Yorkville University, Toronto, Ontario, Canada

A/Prof. Ľubica Ilkovičová Slovak University of Technology in Bratislava, Bratislava, Slovakia

Prof. Sabina Kuc Cracow University of Technology, Kraków, Poland Prof. Viljan Mahnič University of Ljubljana, Ljubljana, Slovenia Prof. George Metaxas University of West Attica, Piraeus-Athens, Greece

Prof. Andrew Nafalski University of South Australia, Mawson Lakes, Adelaide, Australia

Prof. Lucyna Nyka Gdańsk University of Technology, Gdańsk, Poland

Prof. Derek O. Northwood University of Windsor, Windsor, Canada

Prof. Antoni Taraszkiewicz Gdańsk University of Technology, Gdańsk, Poland Prof. Steven Thatcher Central Queensland University, Cairns, Australia

Prof. Jacek Uziak College of Management and Enterprise, Wałbrzych, Poland Prof. Algirdas V. Valiulis Vilnius *Gediminas* Technical University, Vilnius, Lithuania

Dr Aji P. Wibawa State University of Malang, Malang, Indonesia

World Transactions on Engineering and Technology Education

Contents

Z.J. Pudlowski	Editorial	254
P. Gregor	Guest Editorial	255
P. Mika, Ł. Wesołowski & S. Kuc	The impact of the Covid-19 pandemic on the organisation of architecture students' workshops and exhibitions	257
T. Jordaan, M. Havenga & B. Bunt	Mathematical game-based learning: education students' collaboration and on-line experiences during disrupted Covid-19 circumstances	263
R. Ratnadewi, A. Pandanwangi & A. Prijono	Learning mathematics through art in a faculty of engineering	271
M.J. Żychowska	Classroom-based and distance teaching of freehand drawing: a comparative analysis	276
E. Stachura	Designing from afar: the challenges, potentials and limitations of an on-line student design workshop	281
P.W. Rusimamto, Munoto, M. Samani, I G. Buditjahjanto, Ekohariadi, L. Nurlaela & M. Nuh	Assessment of electrical engineering students' creative thinking skills in PLC programming	287
L.M. Dos Santos	The challenges of technological tools and electronic classrooms in regional Australian schools: perspectives from STEM teachers	293
M. Danaher, A. Rhodes & A. Ater Kranov	Assessment of learning outcomes through an asynchronous on-line discussion board	299
D. Pusca & D.O. Northwood	Teaching and learning engineering design: creative methods for remote education	306
K. Smatanová, M. Kamenská & A. Šeligová	Effects of student architecture competitions on learning outcomes in design studio courses	313
M. Kozień-Woźniak	Selected elements of synectics in architectural design studio	319
Ľ. Vitková, V. Kasala, O. Lemak & O. Nováček	Urban design teaching and social inclusion	324
Ľ. Ilkovičová & J. Ilkovič	Industry 4.0 in architecture education	331
Index of Authors		337