

Lecture Notes in Networks and Systems 390

Michael E. Auer  
Hanno Hortsch  
Oliver Michler  
Thomas Köhler *Editors*

# Mobility for Smart Cities and Regional Development - Challenges for Higher Education

Proceedings of the 24th International  
Conference on Interactive Collaborative  
Learning (ICL2021), Volume 2

 Springer

# Lecture Notes in Networks and Systems

Volume 390

## 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, Türkiye

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 <https://link.springer.com/bookseries/15179>

Michael E. Auer · Hanno Hortsch ·  
Oliver Michler · Thomas Köhler  
Editors

# Mobility for Smart Cities and Regional Development - Challenges for Higher Education

Proceedings of the 24th International  
Conference on Interactive Collaborative  
Learning (ICL2021), Volume 2

 Springer

*Editors*

Michael E. Auer  
CTI Global  
Frankfurt am Main, Germany

Hanno Hortsch  
Technische Universität Dresden  
Dresden, Sachsen, Germany

Oliver Michler  
Technische Universität Dresden  
Dresden, Sachsen, Germany

Thomas Köhler  
Technische Universität Dresden  
Dresden, Sachsen, Germany

ISSN 2367-3370                      ISSN 2367-3389 (electronic)  
Lecture Notes in Networks and Systems  
ISBN 978-3-030-93906-9              ISBN 978-3-030-93907-6 (eBook)  
<https://doi.org/10.1007/978-3-030-93907-6>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2022, corrected publications 2022, 2023  
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

# Preface

ICL2021 was the 24th edition of the International Conference on Interactive Collaborative Learning and the 50th edition of the IGIP International Conference on Engineering Pedagogy.

This interdisciplinary conference aims to focus on the exchange of relevant trends and research results as well as the presentation of practical experiences in Interactive Collaborative Learning and Engineering Pedagogy.

ICL2021 has been organized by Technische Universität Dresden and University of Applied Science Dresden, Germany, from September 22 to 24, 2021, as a hybrid event.

This year's theme of the conference was "Mobility for Smart Cities and Regional Development – Challenges for Higher Education".

Again, outstanding scientists from around the world accepted the invitation for keynote speeches:

- **Gyeung Ho Choi**, Professor at Daegu Gyeongbuk Institute of Science and Technology, Korea.  
Speech title: Challenges for Future Mobility
- **Thoralf Knotz**, Head of Department, Fraunhofer Institute IVI, Germany.  
Speech title: *Involvement of Students in the Project Work at Fraunhofer IVI*
- **Krishna Vedula**, Founder and Executive Director of IUCEE, India.  
Speech title: *Addressing the Challenges of Engineering Pedagogy in India*
- **Stefan Odenbach**, Dean of Studies for Mechanical Engineering at TU Dresden, Germany  
Speech title: *Practical Courses without Presence – is this possible?*
- **David Guralnick**, Kaleidoscope Learning, USA  
Speech title: *Successful Learning Experiences Design*
- **Lars Seiffert**, Board Member, Verkehrsbetriebe AG Dresden, Germany  
Speech title: *Priority for Public Transport – Fair and Green*
- **Ulrike Stopka**, Professor for Communications Economics and Management at TU Dresden, Germany

Speech title: *Challenges and Opportunities for a Transport Sciences-Oriented Study Program*

The following very interesting workshops have been held:

- ***Modern Vehicle Engineering Training up to Connected and Automated Driving***

Facilitators: **Oliver Michler, Professor for Traffic Telematics at TU Dresden, Germany, and Toralf Trautmann, Professor for Mechatronics at University of Applied Sciences Dresden, Germany**

- ***From Face-to-Face to Hybrid Events – Experiences with the Digital Transformation of a Conference Series Dealing with Online Network Research***

Facilitator: **Thomas Köhler, Professor for Media Technology at TU Dresden and Director of the Center for Open Digital Innovation and Participation at TU Dresden**

We would like to thank the organizers of the following Special Sessions:

- Games in Engineering Education (GinEE)  
Chair: **Matthias C. Utesch**, FOS/BOS Technik München, Germany
- Entrepreneurship in Engineering Education 2020” (EiEE’20)  
Chair: **Jürgen Jantschgi**, HTL Wolfsberg, Austria
- Engineering Education for “Smart Work” and “Smart Life” (IPW)  
Chair: **Steffen Kersten**, TU Dresden, Germany
- Assessing and Enhancing Student online Participation and Engagement  
Chair: **M. Samir Abou El-Seoud**, The British University in Egypt
- Smart Education of Digital Era  
Chair: **Irina Victorovna Makarova**, Kazan Federal University, Russia

Since its beginning, this conference is devoted to new approaches in learning with a focus to collaborative learning and engineering education. We are currently witnessing a significant transformation in the development of education. There are at least three essential and challenging elements of this transformation process that have to be tackled in education:

- the impact of globalization and digitalization on all areas of human life,
- the exponential acceleration of the developments in technology as well as of the global markets and the necessity of flexibility and agility in education,
- the new generation of students, who are always online and don’t know live without Internet.

Therefore, the following main themes have been discussed in detail:

- Collaborative Learning
- Mobility and Smart Cities
- New Learning Models and Applications
- Project-Based Learning

- Game-Based Education
- Educational Virtual Environments
- Computer-Aided Language Learning (CALL)
- Teaching Best Practices
- Engineering Pedagogy Education
- Public-Private Partnership and Entrepreneurship Education
- Research in Engineering Pedagogy
- Evaluation and Outcomes Assessment
- Internet of Things and Online Laboratories
- IT and Knowledge Management in Education
- Approaches of Online Teaching
- Virtual and Augmented Learning
- Mobile Learning Applications
- Connection between Universities and the Labor Market
- Further Education for Engineering Educators

As submission types have been accepted:

- Full Paper, Short Paper
- Work in Progress, Poster
- Special Sessions
- Workshops, Tutorials.

All contributions were subject to a double-blind review. The review process was very competitive. We had to review more than 500 submissions. A team of about 240 reviewers did this terrific job. Our special thanks go to all of them.

Due to the time and conference schedule restrictions, we could finally accept only the best 156 submissions for presentation.

The conference had more than 250 online and on-site participants from 42 countries from all continents.

Our special thank goes to **Prof. Dr. Thomas Köhler and his team** of Technische Universität Dresden, Germany, who made the hybrid conference a reality. We thank **Sebastian Schreiter** for the technical editing of this proceedings.

ICL2022 will be held in Vienna, Austria.

Michael E. Auer  
ICL General Chair  
Hanno Hortsch  
ICL2021 Chair





## Technical Program Chairs

Oliver Michler	Dresden University of Technology, Dresden, Germany
Toralf Trautmann	University of Applied Sciences Dresden, Germany
Sebastian Schreiter	IAOE, France

## Workshop and Tutorial Chairs

Barbara Kerr	Ottawa University, Canada
Manuela Niethammer	Dresden University of Technology, Dresden, Germany
Claudio Teneiro Leivo	University of Talca, Chile

## Special Sessions Chair

Thomas Köhler	Dresden University of Technology, Dresden, Germany
---------------	---

## Publication Chairs

Steffen Kersten	Dresden University of Technology, Dresden, Germany
Sebastian Schreiter	IAOE, France

## Awards Chairs

Stephan Abele	Dresden University of Technology, Dresden, Germany
Tiiia Rütütmann	Tallinn University of Technology, Estonia

## Local Arrangement Chair

Friedrich Funke	Dresden University of Technology, Dresden, Germany
-----------------	---

## Senior Program Committee Members

Andreas Pester	The British University in Egypt
Axel Zafoschnig	Ministry of Education, Austria
Cornel Samoila	Transylvania University of Brasov, Romania
Doru Ursutiu	University of Brasov, Romania
Eleonore Lickl	College for Chemical Industry, Vienna, Austria
George Ioannidis	University of Patras, Greece

Tatiana Polyakova	Moscow State Technical University, Russia
Tiia Rütütmann	Technical University Tallinn, Estonia

### **Program Committee Members**

Alexander Soloviev	Russia
Buri Triyono	Yogyakarta State University, Indonesia
Christian Guetl	Graz University of Technology, Graz, Austria
Demetrios Sampson	University of Piraeus, Piraeus, Greece
Despo Ktoridou	University of Nicosia, Nicosia, Cyprus
Hants Kipper	Tallinn University of Technology, Tallinn, Estonia
Herwig Rehatschek	Medical University of Graz, Graz, Austria
Igor Verner	Technion, Haifa, Israel
Istvan Simonics	Obuda University, Budapest, Hungary
Ivana Simonova	University of Hradec Kralove, Hradec Kralove, Czech Republic
James Wolfer	Indiana University South Bend, IN, USA
Jürgen Mottok	OTH Regensburg, Regensburg, Germany
Martin Bilek	University of Hradec Kralove, Hradec Kralove, Czech Republic
Matthias Utesch	Technical University of Munich, Munich, Germany
Monica Divitini	NTNU, Gløshaugen, Norway
Nael Barakat	University of Texas at Tyler (UT-Tyler), TX, USA
Pavel Andres	Czech Technical University in Prague, Czech Republic
Rauno Pirinen	Laurea Universities of Applied Sciences, Vantaa, Finland
Santi Caballé	Universitat Oberta de Catalunya, Barcelona, Spain
Teresa Restivo	Universidade de Porto, Porto, Portugal
Stavros Nikou	University of Strathclyde, Glasgow, UK
Stamatios Papadakis	The University of Crete, Greece

### **Local Organizing Committee Members**

Sven Eckelmann	Dresden University of Technology, Dresden, Germany
Dirk Engert	University of Applied Sciences Dresden, Germany

Jörg Neumann

Dresden University of Technology, Dresden,  
Germany

Jacob Romankiewicz

Dresden University of Technology, Dresden,  
Germany

# Contents

## Teaching Best Practices

<b>Efficacy of Training Conditions and Methods for medical Students – A large Sample qualitative longitudinal Study</b> . . . . .	3
Stefan Kerschbaumer, Michaela Meier, and Herwig Rehatschek	
<b>Upgrading Engineering Education for the Chemical Industry of Russia</b> . . . . .	15
Irina V. Pavlova, Andrey A. Potapov, Gulnaz Fakhretdinova, and Phillip A. Sanger	
<b>Introduction of IDEEA (International Design &amp; Engineering Education Association) 2021 Program</b> . . . . .	23
Kwanju Kim and Seungil Lo	
<b>Innovative and Scientific ECO Environment: Integration of Teaching Information and Communication Technologies and Physics</b> . . . . .	29
Olha Kuzmenko, Marina Rostoka, Sofia Dembitska, Yana Topolnik, and Maryna Miastkovska	
<b>Lessons Learned During a Global Pandemic: Teaching Takeaways</b> . . . . .	37
Teresa L. Larkin	
<b>STEM Digital Education During COVID-19 Pandemic: Student’s Perspective and Future Actions</b> . . . . .	45
Eugenio Cataldo, Bert De Vleeschouwer, Elif Yildiran, Ioana Neamtu, and Yoel Alonso	
<b>Transforming a Course into the Online Delivery Mode on a Global Platform: Benefits and Challenges</b> . . . . .	58
Artem Bezrukov and Dilbar Sultanova	
<b>Flexible Learning as a Way of Integrating Russian Doctoral Programmes into European High Education Area</b> . . . . .	66
Julia Lopukhova, Elena Makeeva, and Tatyana Rudneva	

<b>An Analytical Study of Factors Related to TVET Implementation in Thailand as the Centre of Excellence in the Past Decade . . . . .</b>	79
Adisorn Ode-sri, Thomas Köhler, and Pisit Wimonthanasit	
<b>Need Analysis of Stakeholders' Perspectives Regarding the Challenging Factors in Establishing the CoE for TVET in Thailand . . .</b>	91
Adisorn Ode-sri, Thomas Köhler, and Pisit Wimonthanasit	
<b>Overcoming National Stereotypes of Undergraduate Students: Implementing Culturally Diverse Materials and Role-Playing in an EFL Classroom . . . . .</b>	104
Elina Murtazina, Raushan Valeeva, and Olga Y. Khatsrinova	
<b>Chemical School for Gifted Children . . . . .</b>	111
Liliya Ibrasheva, Marina Zhuravleva, Rezeda Bagatova, and Elvira Valeeva	
<b><i>Methodi Quantitative: A Ludic Way for Learning Quantitative Methodology in Psychology . . . . .</i></b>	119
Olga Rodríguez-Jiménez, Jose Ignacio Garcia-Pinilla, Brayam Pineda, Jennifer Andrea Malaver, and Edwin Ariel Galindo León	
<b>From a “Brick-and-Mortar” Project to a MOOC . . . . .</b>	127
Wanessa do Bomfim Machado and Mario Gandra	
<b>Converting a Face-to-Face Laboratory into a Remote Solution System: A Case Study in the Industrial Networks Laboratory . . . . .</b>	135
Virgilio Vasquez-Lopez and Luis Villagomez	
<b>The Peculiarities of Teaching English as a Foreign Language Course . . . . .</b>	146
Diana R. Giniyatullina, Gina V. Ryabkova, Rosa V. Gataullina, Yuliya N. Zatsarinnaya, and Maria M. Volkova	
<b>The Effect of Covid-19 Pandemic on the Regional Universities Research Culture and the Quality of the Engineering Education . . . . .</b>	154
Tanya Stanko, Elena Chernyshkova, Oksana Zhirosh, Alexandra Melnichenko, Yulia Antokhina, Irina Laskina, Marina Khodyreva, Sofya Chernogortseva, Alexey Lopatin, Natalia Sluzova, Sergey Ryabchenko, and Svetlana Lavrova	
<b>Research in Engineering Pedagogy</b>	
<b>Poster: The Role of Mathematical Disciplines in Engineering Practice . . .</b>	169
S. V. Rozhkova and I. G. Ustinova	



**System of Quality Assurance in the University Education During COVID-19 Crisis** . . . . . 177  
 Pavel Andres, Roman Hrmo, and Lucia Krištofiaková

**The Impact of the Pandemic Crisis on Technology Standard of Traditional University Education** . . . . . 187  
 Pavel Andres, Dana Dobrovská, David Vaněček, and Juraj Miština

**Learning Motivation and Quality of the Educational Process** . . . . . 199  
 István Szőköl

**Dedicated Assignments as a Means of Advancing Junior Students’ Systems Thinking and Abstract Thinking** . . . . . 210  
 Aharon Gero, Aziz Shekh-Abed, and Orit Hazzan

**Communication Skills of Educators and Students of an Engineering University** . . . . . 217  
 Mansur Galikhanov, Alina Guzhova, and Inna Zagidullina

**The CEFR for Languages: Research Perspectives in Foreign Language Teaching in Engineering University** . . . . . 225  
 Gulnaz Fakhretdinova, Liliia M. Zinnatullina, Farida T. Galeeva, and Elvira Valeeva

**Foreign Language Training in Engineering Universities: Prospects of Distance Technologies** . . . . . 233  
 Tatiana Polyakova, Liudmila Branitskaya, and Liudmila Zabolotskikh

**Educating AI Software Engineers: Challenges and Opportunities** . . . . . 241  
 Mugdim Bublin, Sigrid Schefer-Wenzl, and Igor Miladinović

**Improving the Quality of Training Future Engineering Personnel on the Basis of the Partnership “University-Industrial Enterprise”** . . . . . 252  
 Olga Y. Khatsrinova, Julia Khatsrinova, Elina Murtazina, and Anna Serezhkina

**Peculiarities of Aggression Manifestation in the Educational and Professional Activity of Students in Online and Offline Learning** . . . . . 267  
 Valery Viktorovna Khoroshikh, Elena Borisovna Gulk, Tatiana Anatolyevna Baranova, and Marina Vasilyevna Olennikova

**Features of Coping Strategies of Students of a Technical University with Different Experience of Participation in Group Activities** . . . . . 275  
 Aleksandra Vladimirovna Komarova, Tatyana Viktorovna Slotina, Konstantin Pavlovich Zakharov, Valery Leonidovich Sitnikov, and Artem Vasilevich Sugorovsky

**Overseas Study Tour Organization as a Factor of Intercultural Communication Development of Engineering University Students** . . . . . 283  
 Ekaterina Tsareva, Leisan Khafizova, and Elena Yurievna Semushina

<b>Enhancing Leadership Skills of Undergraduate Engineering Students Through Events and Festivals</b> . . . . .	290
Petr Osipov, Julia N. Ziyatdinova, Liudmila Dulalaeva, and Gulnaz Fakhretdinova	
<b>Innovative Teaching Methodology in Engineering Education: Accepting the Challenges of 4.0. Industry</b> . . . . .	297
Guzel Rafaelevna Khusainova, Alina Rafisovna Ibatullina, Veronika Vladimirovna Bronskaya, Ramil Ravilyevich Mingaliev, Liudmila Anatolevna Kitaeva, and Farida T. Shageeva	
<b>Possibilities of the Collage Method in the Formation of Soft-Skills of Future Engineers</b> . . . . .	305
Aleksandra Vladimirovna Komarova, Tatyana Viktorovna Slotina, Konstantin Pavlovich Zakharov, Elena Borisovna Gulk, and Olga O. Kunina	
<b>Providing Physical and Virtual Mobility for a Regional University-Based Technology Park</b> . . . . .	313
Alexander Gerashchenko, Tatiana Shaposhnikova, Alena Egorova, Olga Gordienko, and Victoria Vyazankova	
<b>Research Area as a Cornerstone of Developing Engineering Education in Global Society</b> . . . . .	323
Natalia E. Tiourina, Vladimir V. Nasonkin, Dmitry V. Bondarenko, Svetlana V. Barabanova, and Maria S. Suntsova	
<b>Employers Requirements for Graduates of Vocational Education and Training in Study Branches Transport and Automotive Service and Repair</b> . . . . .	331
Alena Hašková, Dominik Zatkalík, and Martin Zatkalík	
<b>Importance of Relationships of Key Competences to Activating Methods</b> . . . . .	340
István Szőköl and Simona Benková	
<b>Teacher Communication in Online Distance Education at a Czech Higher Education Institution</b> . . . . .	349
Ludmila Faltynkova, Ivana Simonova, and Katerina Kostolanyova	
<b>Example of Gamification Supporting Elimination of Shortcomings in Pupils' Learning Achievements</b> . . . . .	361
Ján Záhorec, Alena Hašková, and Peter Brečka	
<b>Typical Engineering Thinking and Consequences for the Methodology of Teaching in Engineering Education</b> . . . . .	373
Steffen Kersten	

**Factors Determining the Student's Prior Mathematical Experience . . . .** 385  
 Anna Vintere and Liga Zvirgzdina

**Distance Education Technologies and the Present Situation Influenced  
 by the Pandemic . . . . .** 396  
 Ján Hargaš, Darina Matisková, and Juraj Miština

**Study of Relationship Between the Learning Methods and the  
 Assessment Methods of Engineering and Management Students  
 Studying the Internet of Things Knowledge Areas . . . . .** 408  
 Arjun Singar

**Development of Engineering Education in Russia: A Historical  
 Perspective . . . . .** 421  
 Andrey Morozov, Roman Kupriyanov, and Nailya Sh. Valeyeva

**Students Perceptions of Online Laboratory Reporting in Electronics  
 Engineering: Analysis on Merits and Demerits . . . . .** 431  
 Elisha Didam Markus and Ntombizanele Maqache

**Engineering Pedagogy Education**

**Poster: Design and Evaluation of an Extracurricular Educational  
 Program for Developing the Basic Skills as a Member of Society . . . . .** 441  
 Kazuya Takemata, Akiyuki Minamide, Satoshi Fujishima,  
 and Arihiro Kodaka

**Poster: Practical Examples of Basic Data Science Course for Junior  
 High and High School Students in Club Activity . . . . .** 449  
 Satoshi Fujishima, Kazuya Takemata, and Akiyuki Minamide

**Tailor-made Hybrid Learning for Engineering Students  
 in Peripheral Colleges . . . . .** 456  
 Eran Gur

**Focusing a Technology Teacher Education Course on Collaborative  
 Cloud-Based Design with Onshape . . . . .** 465  
 Dan Cuperman, Igor Michael Verner, Laura Levin, Moshe Greenholts,  
 and Uzi Rosen

**Integrating Sustainability into Language Teaching  
 in Engineering University . . . . .** 478  
 Gulnaz Fakhretdinova, Liliia M. Zinnatullina, and Ekaterina N. Tarasova

**STEM Student Recruitment Tools in Higher Education . . . . .** 485  
 Tamas Kersanszki and Istvan Simonics

<b>Correlation Between Successful Study Material Comprehension in Distance Learning and Students' Personality Traits</b> . . . . .	497
Irina Zaripova, Nailya Sh. Valeyeva, Roman Kupriyanov, and Renat Zaripov	
<b>The Relationship Between Motivation for Studying and Academic Adaptation Levels of First-Year Students</b> . . . . .	506
Dzhamilia Nugmanova, Roman Kupriyanov, and Nailya Sh. Valeyeva	
<b>Organizing Academic Mobility of Engineering Students to Universities of France</b> . . . . .	513
Natalia V. Kraysman, Farida T. Shageeva, and Andrei B. Pichugin	
<b>Integrative Psychological and Pedagogical Disciplines at an Engineering University</b> . . . . .	521
Tatiana A. Starshinova and Natalia V. Kraysman	
<b>Reflection in Teaching Psychological and Pedagogical Disciplines in Multi-level Engineering and Science Education</b> . . . . .	528
Tatiana A. Starshinova, Evgeniia L. Vavilova, Natalia V. Kraysman, and Vladimir V. Kondratyev	
<b>The Study of Subjective Content and Conditions for Generating the Professional Development Path in University Environment</b> . . . . .	536
Elena Yu. Turner, Tatiana N. Nikitina, Natalia V. Kraysman, Fyodor G. Myshko, and Alla A. Kaybiyaynen	
<b>Features of Practical Engineering Teacher Education in Hungary</b> . . . . .	544
Ildikó Holik and István Dániel Sanda	
<b>Updated Curriculum for Engineering Pedagogical Continuing In-Service Education</b> . . . . .	556
Tiia Rüttnann, Ivar Annus, Jakob Kübarsepp, Urve Läänemets, and Jaak Umborg	
<b>Problems of Awareness in Choosing of a Future Profession</b> . . . . .	568
Dilbar Sultanova, Anna Maliashova, and Ekaterina Zimina	
<b>Technology of Using Mind Maps Based on a Polyisomorphic Model of Semantic Features of Mindmapping Services Description</b> . . . . .	576
Denys Kovalenko, Juergen Koeberlein-Kerler, Liudmyla Shtefan, Larysa Bachiieva, and Viktoriia Kovalska	
<b>Training of Future Engineers-Teachers of Interdisciplinary Communications Modelling with Using of Computer Technologies</b> . . . . .	584
Olena Kovalenko, Juergen Koeberlein-Kerler, Nataliia Bozhko, Tatjana Yaschun, and Tetiana Bondarenko	

**Training of Students of Engineering and Pedagogical Specialties of Developing Educational Internet Projects** ..... 592  
 Olena Kovalenko, Juergen Koeberlein-Kerler, Nataliia Briukhanova, Nataliia Korolova, and Olha Lytvyn

**Simulator for the Formation Programming Skills Based on Solving Problems of Controlling a Virtual Robot** ..... 600  
 Tetiana Bondarenko, Vasyl Yahupov, Oleksandr Kupriyanov, Evhenyi Hromov, and Nataliia Briukhanova

**CCTV as an Element of the Quality Management System of the Learning Process in Education Institutions** ..... 608  
 Tetiana Bondarenko, Vasyl Yahupov, Volodymyr Streltsov, Olha Ahieieva, and Luis Cardoso

**Predicting the Educational and Cognitive Activity of Teaching Engineers in Computer Science Based on Mathematical Models** ..... 616  
 Olena Kovalenko, Liudmyla Shtefan, Tatjana Yaschun, Tetiana Bondarenko, and Kyrilo Ohdanskyi

**Transformation of the Role of University Teacher in the Digital Age** ..... 624  
 Elena Borisovna Gulk, Victor Nicolaevich Kruglirov, Konstantin Pavlovich Zakharov, and Olga O. Kunina

**Development and Implementation of the Module “Engineering, Education and Pedagogy in Industry 4.0” in the Structure of the Curriculum “Innovative Pedagogy for Teachers of Engineering Universities” (iPET)** ..... 632  
 Vladimir V. Kondratyev, Ulyana A. Kazakova, and Maria N. Kuznetsova

**Priorities of Vocational Training of Educators of Engineering Universities in the Formation of Their Psychological and Pedagogical Competency** ..... 644  
 Ulyana A. Kazakova, Vladimir V. Kondratyev, and Maria N. Kuznetsova

**From Career Guidance of Schoolchildren to Professional Training of Future Engineers at University of Engineering and Technology** ..... 654  
 Aleksey M. Kuzmin, Olga O. Kunina, Artem M. Fedorov, and Julia V. Timofeeva

**Ontological Modeling of Electronic Educational Resources** ..... 661  
 Andrii Guraliuk, Marina Rostoka, Anna Koshel, Yevheniia Skvorchevska, and Olga Luchaninova

**Information Technology in Forming Engineering Competencies in Technological University Students During Pandemic** ..... 669  
 Zulfiya K. Kadeeva and Natalia V. Kraysman

<b>Using Business Games to Build Engineering Competencies in Technological University Students</b> . . . . .	676
Zulfiya K. Kadeeva, Natalia V. Kraysman, and Elena N. Kadeeva	
<b>Blended Learning: Design and Organization Features on the Basis of the Use of Online Training Technologies</b> . . . . .	684
Natalia P. Goncharuk, Farida T. Shageeva, and Evgeniya I. Khromova	
<b>Feminization of Engineering in the Situation of Modern Technological Revolutions</b> . . . . .	696
Larisa M. Bogatova, Natalia V. Kraysman, Venera M. Tokar, and Petr Osipov	
<b>Lessons Learnt in an Online Teaching Environment, and Cues for the Future</b> . . . . .	702
Gaganpreet Sidhu, Seshasai Srinivasan, and Dan Centea	
<b>Volunteering as One of the Ways of Developing Engineering Students' Soft Skills</b> . . . . .	709
Petr Osipov, Liudmila Dulalaeva, Gulnaz Fakhretdinova, and Alla A. Kaybiyaynen	
<b>Metacognitive Skills of Engineer Students of Different Levels of Education in EFL Learning</b> . . . . .	717
Nailya Sh. Valeyeva, Roman Kupriyanov, and Elvira Valeeva	
<b>Special Aspects of Organizing Teaching Activities by Simultaneous Learning</b> . . . . .	726
Natalya N. Gazizova, Nataliya V. Nikonova, Maria S. Suntsova, Svetlana V. Barabanova, and Irina A. Strelnikova	
<b>Information Security in Educational Environment</b> . . . . .	737
Ekaterina Tsareva, Roza Bogoudinova, and Gulnara F. Khasanova	
<b>Culture and Multitude of Learning Models: Using Digital Educational Resources in Solving Applied Problems</b> . . . . .	743
Svetlana R. Enikeeva, Alexander V. Troitsky, Nataliya V. Nikonova, Svetlana V. Barabanova, and Maria S. Suntsova	
<b>Use of Specially Designed Simple Experimental Device Based on Raspberry Pi by Students for the Conceptual Understanding of Rotational Motion</b> . . . . .	753
Georgios Kalantzis, Charilaos Tsihouridis, Marianthi Batsila, and Dennis Vavougiios	
<b>A Comparative Study of the Organization of a Remote Mathematics Study Process During the Covid-19 Pandemic</b> . . . . .	764
Anna Vintere, Eve Aruvee, and Daiva Rimkuvieni	



**Smart Cities Demo System Supported with Online Tools Used in Engineering Education** . . . . . 776  
 Gabriele Schachinger, Martin Izaak, Gerald Kalteis, and Clemens Leidenmühler

**Work-in-Progress: The Potential of Interactive Scripts – Supporting Conceptual Understanding and Collaborative Problem-Solving Skills** . . . . . 784  
 Katrin Temmen, Peter Kersten, and Dominik Schäfer

**Work in Progress: Educational Ecosystem of Teaching Russian as a Foreign Language in Technical Universities** . . . . . 792  
 Elena Makeeva, Julia Lopukhova, and Ekaterina Gorlova

**European Digital Competence Frameworks and Engineering Pedagogy** . . . . . 800  
 Joachim Hoefele

**Entrepreneurship in Engineering Education**

**The Potential for Transformation into the Virtual Organization of Remote Experiment Networks** . . . . . 815  
 C. Samoila, D. Ursutiu, and H. Modran

**The European Awards “VET Innovator” and “The Entrepreneurial School”** . . . . . 826  
 Jürgen Jantschgi and Markus Liebhard

**The Phenomenon of ‘Opportunity Recognition’ Among Engineering Students** . . . . . 837  
 Judith Klamert-Schmid, Sabine Zangl, and Maximilian Lackner

**The Role of Legislative Policy Entrepreneurs in Bridging the Digital Gaps for Immigrants in Host Communities Amidst Global Health Crises** . . . . . 846  
 Muhammad Hassan Bin Afzal

**Entrepreneurship Education and Innovation Transfer Through Student Practice Projects** . . . . . 858  
 Thomas Wala and Christine Salmen

**The Usage of Challenge-Based Learning in Industrial Engineering Education** . . . . . 869  
 Manuel Woschank, Corina Pacher, Phillip Miklautsch, Alexander Kaiblinger, and Mariaelena Murphy

**Transition, Innovation and Sustainability Environments, TISE: A Showcase of Education Geared Towards Societal Challenges and Future Orientation** . . . . . 879  
 Kay Mühlmann, Liliya Satalkina, Lukas Zenk, and Gerald Steiner

<b>Beyond Simple: Entrepreneurship as a Driver for Societal Change . . . .</b>	<b>888</b>
Liliya Satalkina, Lukas Zenk, Kay Mühlmann, and Gerald Steiner	
<b>Project Based Learning</b>	
<b>Poster: Educational Effects of PBL Education in Collaboration with Company . . . . .</b>	<b>899</b>
Akiyuki Minamide, Kazuya Takemata, Satoshi Fujishima, and Arihiro Kodaka	
<b>Interactive and Collaborative Activities of the Extra-Curriculum Project Team of Undergraduate Students Under COVID-19 Pandemic Situation and Their Educational Effects . . . . .</b>	<b>906</b>
Makoto Hasegawa	
<b>Project-Based Learning: For Teachers and School Students . . . . .</b>	<b>913</b>
Olga Y. Khatsrinova, Irina V. Pavlova, and Inna M. Gorodetskaya	
<b>Online Offshore Delivery of a Multidisciplinary Study-Abroad Engineering Project . . . . .</b>	<b>926</b>
Avinda Weekoon and Nathan Dunbar	
<b>Project Activity in the Formation of Subject Competencies . . . . .</b>	<b>939</b>
O. V. Yanuschik, I. G. Ustinova, O. N. Imas, and S. V. Rozhkova	
<b>The Adaptation of Online Project-Based Learning in Computer Engineering Education Settings . . . . .</b>	<b>947</b>
Yunfei Hou, Fadi Muheidat, Amir Ghasemkhani, Qingquan Sun, Haiyan Qiao, Miranda McIntyre, and Montgomery Van Wart	
<b>Water Management in Several Types of Soil – A Hands-On Science Experiment for Students . . . . .</b>	<b>956</b>
Amélia Caldeira, Sofia O. Lopes, Maria Teresa Malheiro, Rui M. S. Pereira, A. Manuela Gonçalves, Nuno Araújo, and Paulo A. Pereira	
<b>Theory or Practice: Student Perspective on Project Based Learning Versus Module Based Learning to Improve Technical Skills Among IT Undergraduates . . . . .</b>	<b>968</b>
Uthpala Samarakoon, Kalpani Manathunga, and Asanthika Imbulpitiya	
<b>Virtual and Augmented Learning</b>	
<b>New Trends in Training Methodologies . . . . .</b>	<b>983</b>
Dana Dobrovská and David Vaněček	
<b>Engineering Experiential Learning During the COVID-19 Pandemic . . . . .</b>	<b>991</b>
Nael Barakat, Aws Al-Shalash, Mohammad Biswas, Shih-Feng Chou, and Tahsin Khajah	

**Collaborative Multi-user Augmented Reality Solutions in the Classroom** ..... 1004  
Stefano Masneri, Ana Domínguez, Miguel Sanz, Iñigo Tamayo, Mikel Zorrilla, Mikel Larrañaga, and Ana Arruarte

**Use of VR in Engineers Certification at Hazardous Production Facilities in Petrochemical Industry** ..... 1012  
Alina Fanisovna Domracheva, Gulnara F. Khasanova, and Mansur Galikhanov

**Immersive Virtual Training for Vocational Training High School Students’ Milling Machine Practice** ..... 1019  
Jungmin Shin and Sang-Youn Kim

**VR-Technologies in Foreign Language Learning for Engineering Students** ..... 1027  
Julia N. Ziyatdinova, Gulnaz Fakhretdinova, Diana R. Giliazova, and Irina V. Pavlova

**Digitality as a Challenge - Digital Learning as an Answer? Consequences of Engineering Teaching** ..... 1035  
Ralph Dreher

**Data Processing and Visualization with Matlab: Introducing an IT Component to Training Chemical Engineers** ..... 1048  
Artem Bezrukov and Dilbar Sultanova

**Digital Spaces as an Opportunity for Supporting Complex Learning Strategies in Human-Machine Interaction** ..... 1059  
Andrea Dederichs-Koch and Ulrich Zwiwers

**Immersive Learning in Healthcare and Medical Education**

**Technical Guidelines for the Creation and Deployment of 360° Video-Based Virtual Reality (VR) Reusable Learning Objects (RLOs)** ..... 1073  
Fotos Frangoudes, Eirini C. Schiza, Kleanthis C. Neokleous, and Constantinos S. Pattichis

**Data Modelling for Visual Entities to Streamline Virtual Patient Re-purposing in Virtual Reality** ..... 1085  
Lazaros Ioannidis, Panagiotis Antoniou, and Panagiotis Bamidis

**Repurposing a Reusable Learning Object on Effective Communication with Adolescents to an Interactive 360° Immersive Environment by Adapting the ASPIRE Framework** ..... 1096  
Matthew Pears, James Henderson, and Stathis Konstantinidis

**Immerse Yourself in ASPIRE - Adding Persuasive Technology Methodology to the ASPIRE Framework** . . . . . 1106  
Michael Taylor, Heather Wharrad, and Stathis Konstantinidis

**Digital Soft Skills of Healthcare Workforce – Identification, Prioritization and Digital Training** . . . . . 1118  
Stathis Konstantinidis, Liza Leonardini, Claudia Stura, Peggy Richter, Paola Tessari, Marjolein Winters, Olivia Balagna, Riccardo Farrina, Ad van Berlo, Hannes Schlieter, Oscar Mayora, and Heather Wharrad

**Correction to: Use of Specially Designed Simple Experimental Device Based on Raspberry Pi by Students for the Conceptual Understanding of Rotational Motion** . . . . . C1  
Georgios Kalantzis, Charilaos Tsihouridis, Marianthi Batsila, and Dennis Vavougiios

**Correction to: Improving the Quality of Training Future Engineering Personnel on the Basis of the Partnership “University-Industrial Enterprise”** . . . . . C2  
Olga Y. Khatsrinova, Julia Khatsrinova, Elina Murtazina, and Anna Serezhkina

**Correction to: From a “Brick-and-Mortar” Project to a MOOC** . . . . . C3  
Wanessa do Bomfim Machado and Mario Gandra

**Author Index** . . . . . 1131

# **Teaching Best Practices**



# Efficacy of Training Conditions and Methods for medical Students – A large Sample qualitative longitudinal Study

Stefan Kerschbaumer<sup>1</sup> (✉) , Michaela Meier<sup>2</sup> , and Herwig Rehatschek<sup>3</sup> 

<sup>1</sup> Department of Radiology, Division of Nuclear Medicine, Medical University of Graz Austria, Graz, Austria

stefan.kerschbaumer@medunigraz.at

<sup>2</sup> Institute of Psychology, Karl-Franzens-University Graz Austria, Graz, Austria

<sup>3</sup> Department for Learning with Media, Medical University of Graz Austria, Graz, Austria

**Abstract.** To investigate medical students' learning preferences is the key to successfully adapt to the changing demands and technological opportunities.

Between 2014 and 2019 we sent out 14916 anonymous questionnaires once a year to all medical students at the Medical-University of Graz Austria.

A share of 18% (N = 2799) of invited participants completed the survey. The challenge for students is time management. Students can learn efficiently, if bureaucracy do not get out of hand. The examination system has significant effects on the way and quality of learning and on time management. Especially for in-depth learning, it is difficult and time consuming to select from the available resources and to sort out the relevant examination material. The preferred learning resources for exams are still lecture material and books. The learning preferences do not change much during the course of studies, furthermore the gender differences are in general slightly more noticeable at the beginning but they even out fast during the course of medical school.

To reach the goal of producing well trained graduates, the education institution has to guide the students from a more school-like setting at the begin of their education in the preclinical years to self-employed physicians at the end of their studies.

**Keywords:** Medical teaching · Virtual learning · Best practice

## 1 Introduction

Not only the starting situation of medical students, but also the medical profession, the professional environment, the technological progress in medicine and the nature and needs of patients are more diverse than any time in the past. For these named reasons it is hardly surprising that the requirements and also the challenges [1, 2] posed to the students provide a wide and valuable field of research. Even the daily newspapers have recently discussed the quality of medical education and training [3–5]. But all common arguments seem to be unilateral and do not go into depth of the problems of the students



and look even less into possible solutions and advances. Therefore, this survey was conducted in order to study the learning behavior and the preferred learning strategies from the student's point of view.

"The environment that people live in, is the environment that they learn to live in, respond to, and perpetuate. If the environment is good, so be it. But if it is poor, so is the quality of life within it." from Ellen Swallow Richards.

The preparation for this project began in 2013. The first objective of our project group was to improve the level of knowledge transfer. During the initial discussion of this project, it was apparent that in order to do so, it is essential to gain a better understanding of the needs of the students. All the needs of the individual students and the academic teaching are inextricably linked [6, 7]. Bearing in mind that this study focuses on the student's needs, it represents just this part of the educational system [8]. According to the learning objectives, those results should subsequently lead to improved teaching and quality of the medical studies. An anonymous questionnaire was developed to evaluate demographic data and six different learning dimensions: time management, medical interest, learning methodologies, learning strategies, learning motivation, and learning appreciation.

Recent research topics oftentimes cover individual aspects of the students' needs. Comparable studies were more commonly conducted in the area of adult education or business-consulting. Although findings from other disciplines may have some relevance, they cannot be transferred blindly due to the specific requirements of medical students.

Hillard [9], found in his research that the study methods are significantly determined by the assessment method. Multiple choice questions fostered rote memorization and surface learning, whereas free response written questions and clinical examinations encourage in-depth learning. The term "in-depth" or "deep-learning" is here used in opposite to superficial learning without an interrelated understanding [10]. An in-depth learning approach to studying is linked with academic success [11].

Learning styles are extensively discussed in current research. Pashler [12] concluded that "there is no adequate evidence base to justify incorporating learning styles assessments into general educational practice." The recent scientific findings do not provide any evidence in favor of one of the known learning style models [13].

Teaching has many different dimensions like expertise, technical performance, and joy of teaching or social skills [14]. All these depend on the education, experience and personality of the educator. On the one hand, expertise and technical performance can be easily evaluated and developed. The evaluation and development of didactic skills and joy of teaching or social competence on the other hand, is much more difficult [15, 16].

Information technologies provide a wide range of opportunities. E-learning has already become an extensive part of the education system [17–20]. It has the potential to provide benefit to academic learning [21]. With the introduction of new IT-systems, computer skills and acceptance of those systems were examined. Link [18] found that only a small percentage of students lack basic computer skills and/or are very skeptical about e-learning. About 12% make little or no use of existing e-learning offerings. Wynter [1] concluded that the increasing use of question banks raises the risk of poor alignment to medical school curricula. Han [22] summarized that students in the preclinical and clinical years need different educational technology.

Kılıç [23] assumed that learning differences between males and females could be related to motivation, authority orientation and responsibility. There are contradictory findings whether or not women and men have different learning orientations. Cultural differences do not play a significant role in students' preferred learning methods or learning styles [24, 25]. In adult education it is most important to achieve the expected goals and the ability to put the knowledge into practice. Adults are in general more open for different didactic methodologies and they therefore endorse non-conventional procedures [26].

## 2 Methods

The Faculty of Medicine at the University of *Graz*) was established 1863 and became an independent university in 2004. The degree program is limited to 336 students per year for human medicine and 24 for dental medicine. Due to an entrance exam the dropout rate is less than 10% and more than 82% complete within the designated time plus one semester.

From 2014 to 2019 an anonymous questionnaire was sent to all medical students by e-mail (students' account) once a year. They had one month to complete the survey. EvaSys Ver. 7.1 (Electric Paper Evaluationssysteme GmbH Lüneburg, Germany) was used for sending the link to the online-questionnaire by e-mail and to administrate the results.

The questionnaire was sent to 14916 students in total (2486 per year). The number of completed questionnaires was 2799, which resulted in an annual response rate of  $18 \pm 4\%$ . The e-mail contained an information notice regarding the project and a link to the questionnaire. The online questionnaire was structured in seven sections: demographic data, time management, medical interest, learning methodologies, learning strategy, learning motivation, and learning appreciation – in total 41 questions (including four free text questions) were asked. To avoid even the slightest impression of judgement and manipulation no ordinal or metric scales were applied [27].

To evaluate the free text questions the ranking of the frequently used words (term frequency) were evaluated visually as table- and as bar-chart – also separately filtered for male and female. In case the context of the investigated words was crucial, all text passages for this specific word were analyzed.

The data from EvaSys are available in the form of an ASCII files in CSV format. Python (Version 3.7.1) [28] under Jupyter Notebook (Version 5.7.0) [29] were used to calculate and display the numerical and statistical results. Pandas (version 0.24.2) [30] were used as a data analysis library. Numpy handled the data arrays (version 1.16.4) [31]. Matplotlib (version 3.1.0) [32] was used as plotting library.

The curriculum for medical students is structured in three study sections. The first section lasts two years, and covers pre-clinical subjects, fundamental knowledge and comprehension, and the basis for the cause of the disease, professional doctor-patient interaction and includes a clinical internship. The second study section lasts 3 years and provides putting their theoretical knowledge into practice within the clinical context. The purpose is to be able to explain and apply clinical skills. It covers the different clinical disciplines, as a base for scientific work, psychology, ethic and law. The last section

lasts for one year and is the “clinical internship year” and the program concludes with a diploma thesis. The entire course is scheduled for a duration of 12 semesters.

The data arrays were filtered for gender and for the academic years in groups of the first two years (first and second year – preclinical students), the subsequent four years (until the 12<sup>th</sup> semester – clinical students), the following three years (clinical internship students) and a separate group for students beyond (long-term students).

The last question was adopted from Steve the Shazer. He invented the miracle question for the solution-orientated brief therapy. The miracle question has the advantage to focus on the solution instead of the problem. It is well suited to substantiate the desired states and express the necessary steps to reach those [33].

### 3 Results

#### Demographic Information

The gender distribution of respondents to the online survey was 51% (1433) female and 49% (1366) male. The students per group were 1225 preclinical students, 1233 clinical students, 291 clinical internship students, and 50 long-term students.

The majority, which consists of 37% (1029) of the students, did not work during the semester. This decreases from 42% for preclinical students, 30% for clinical students, 29% for clinical internship students to 13% for long-term students. Students who only worked during their holidays also decrease from 39% for preclinical students, 28% for clinical students, 24% for clinical internship students to 14% for long-term students. The number of students who worked half-time increased from 13% for preclinical students to 30% for preclinical students, 29% for clinical internship students, and 47% for long-term students. A minority of 3% worked more than half-time and 5% worked in the evening or at night.

#### Time Management

The majority, which consists of 38% (1066), had enough time to study and 37% (1048) experienced stress before exams. The remaining percentage of 24% (685) claimed that they have too little time to study. Within the first 2 years of their studies, 44% of the male and 30% of the female students had the feeling they had enough time and 36% male and 45% female students experience stress before exams – 20% of the male students and 25% female students did had too little time for their study. These gender differences aligned in the higher semesters.

The majority, which consists of 68% (1901) started to study a few weeks before an exam, 22% (602) study on an ongoing basis with a short preparation period before an exam and the remaining 11% (296) studied and learned on an ongoing basis. The most efficient time to study was before noon (43% female, 34% male), followed by the night (25% female, 32% male). While more females (18% female, male 14%) preferred the early morning and more males 21% (14% female) preferred the evening.

### Medical Interest

The preference for specific medical disciplines rose during academic training. For the first two years, this was 56% (686) and increased to 79% (971) for clinical students and 86% (251) for clinical internship students. In total 30% (850) of the students did not choose a specific discipline. The highest interest level was 19% in internal medicine followed by 17% for surgery and 15% for other medical divisions (e.g. cardiology, endocrinology, hepatology), 6% for general medicine (without specialization), 4% for neurology, 3% basic medical disciplines (e.g. anatomy, physiology, cytology), and 2% for diagnostic medicine (e.g. in-vitro diagnostic, radiology, nuclear medicine) and 2% for medical research. In total 52% (1460) of the students (55% female, 46% male) had only gotten a rough vision about their future professional practice. A percentage of 28% (796) had a fairly clear and precise vision, 10% (270) of students had a clear and precise vision and the remaining 10% (273) had not even a rough vision about their future professional practice.

A free-text question asked for the main strengths for the professional practice as a physician. The most important group of characteristics mentioned was “empathy” (766 times) and “social competency” (385 times). Secondly “know-how” and “expertise” was mentioned 650 times followed by “calmness” and “patience” for 300 times and “endurance” and “perseverance” mentioned 291 times.

### Learning Methodologies

As best teaching setting – classroom-teaching style was claimed in 5% (145) while a mixture of classroom teaching and practice dominates with 66% (1884). The remaining 28% (770) voted for a practical clinical setting. For 86% (2397) of the students new topics should start with an overview to provide orientation, 8% (230) would like to start a new topic with information about the latest research findings and 6% (172) would like to hear important details and features about the new subject first. 65% (1826) of students believe that patient cases which are used for training should contain all the relevant information and 30% (844) of students are satisfied using cases mixed with complete and with incomplete patient records. Only 5% (129) chose incomplete and therefore more practical patient records for their training. For didactic teaching-cases 54% (1521) voted for complete information of cases and 46% (1278) voted for incomplete and therefore more practical cases – this rises from 50% for preclinical students and 56% for clinical students up to 64% for clinical internship students. The preferred time to obtain additional information about a case study is debriefing for 54% (1511) of students. For 19% (532) it is in a preparatory discussion and for 27% (758) it is during the presentation of the case.

A contemporary association between theory and practice was important to 60% (1754; from 64% for preclinical students, 60% for clinical students to 55% for clinical internship students and 47% for long-term students). Additional case studies were required by 15% (436; rising from 11% for preclinical students, 14% for clinical students up to 21% for clinical internship students). The discussion with experts stayed at 6% (171) during the whole study. To build skills and competences 43% (1199) voted for independent work under supervision. Second choice with 27% (754; 29% female, 23% male) was to work under guidance and 16% (446; 18% female, 13% male) are interested in attending case discussions. The remaining percentage of 7% (201) saw exhaustive